A STUDY TO COMPARE THE EFFICACY OF 0.5% TIMOLOL EYE DROPS VERSUS 0.2% BRIMONIDINE EYE DROPS IN MANAGEMENT OF RISE IN IOP FOLLOWING Nd-YAG CAPSULOTOMY.

Dissertation submitted in

Partial fulfilment of the regulations required for the award of

M.S. Degree in Ophthalmology

April 2015

THE TAMIL NADU Dr M.G.R. MEDICAL UNIVERSITY

CHENNAI, TAMIL NADU

DECLARATION

I hereby declare that this dissertation entitiled **"A STUDY TO COMPARE THE EFFICACY OF 0.5% TIMOLOL EYE DROPS VERSUS 0.2% BRIMONIDINE EYE DROPS IN MANAGEMENT OF RISE IN IOP FOLLOWING Nd-YAG CAPSULOTOMY."** is a bonafide and genuine research work carried out by me under the guidance of **Dr .M.Hemanandini. M.S.(ophthal) , D.O, HOD,** Department of Ophthalmology, Coimbatore Medical College & Hospital, Coimbatore.

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A STUDY TO COMPARE THE EFFICACY OF 0.5% TIMOLOL EYE DROPS VERSUS 0.2% BRIMONIDINE EYE DROPS IN MANAGEMENT OF RISE IN IOP FOLLOWING Nd-YAG CAPSULOTOMY.

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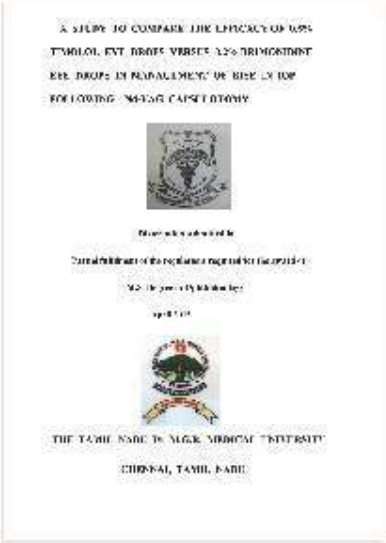

A STUDY TO COMPARE THE EFFICACY OF 0.5% TIMOLOL EYE DROPS VERSUS 2% DORZOLAMIDE EYE DROPS IN MAINTAINMENT OF RISE IN IOP FOLLOWING MANUAL CATARACT SURGERY

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI, TAMIL NADU

A STUDY TO COMPARE THE EFFICACY OF 0.5% TIMOLOL EYE DROPS VERSUS 0.2% BRIMONIDINE EYE DROPS IN MANAGEMENT OF RISE IN IOP FOLLOWING Nd-YAG CAPSULOTOMY.

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ABBREVIATIONS

Nd YAG – Neodymium-doped Yttrium Aluminium Garnet

SIMC – Senile Immature Cataract

SMC – Senile Mature Cataract

PCO – Posterior Capsular Opacification

V/A - Visual Acuity

UCVA - Uncorrected Visual Acuity

BCVA - Best Corrected Visual Acuity

WHO - World Health Organisation

POD - Post Operative Day

D.O.A. – Date of Admission

D.O.S. - Date of Surgery

D.O.P. - Date of Procedure

RE - Right eye

LE - Left eye

SLE - Slit Lamp Examination

IOP- Intra Ocular Pressure

CCT - Central Corneal Thickness

PH - Pin Hole

PG - Prescribed Glass

PCIOL - Posterior Chamber IOL

NPCB - National Program for Control of Blindness

NCT – Non Contact Tonometer

AT- Applanation Tonometer

IOL – Intra Ocular Lens

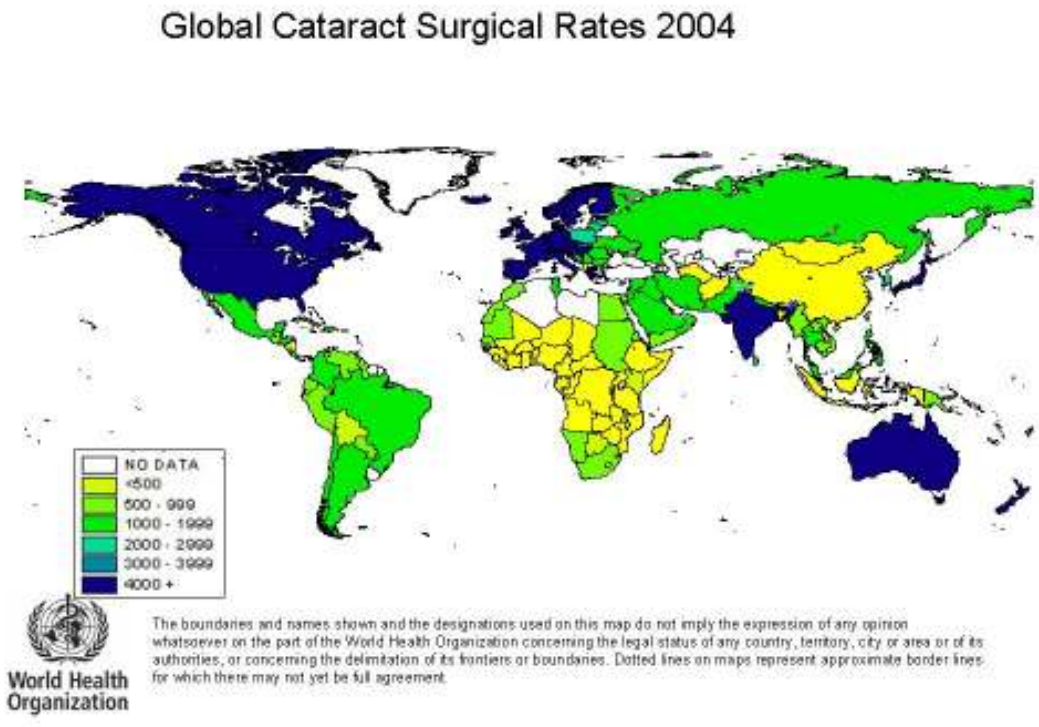
CME – Cystoid Macular Edema

ECCE- Extra Capsular Cataract Extraction

INTRODUCTION

Cataract is the loss of transperancy of the lens of the eye caused by the opacification and degeneration of the already formed lens fibers with formation of abberant lens fibers and deposition of other materials in their place.[1] In most cases it is related to the ageing process, rarely children are born with this condition, or it may develop after, inflammation ,eye injury, and other eye diseases**.**

According to the latest assessment, it is the cause for 51% of world blindness, which represents about 20 million people (2010).[1]



PICTURE 1

Anatomy of the lens

Crystalline lens is a transparent and a biconvex structure whose functions are- --

to maintain its own clarity

to refract light

accomadation[2]

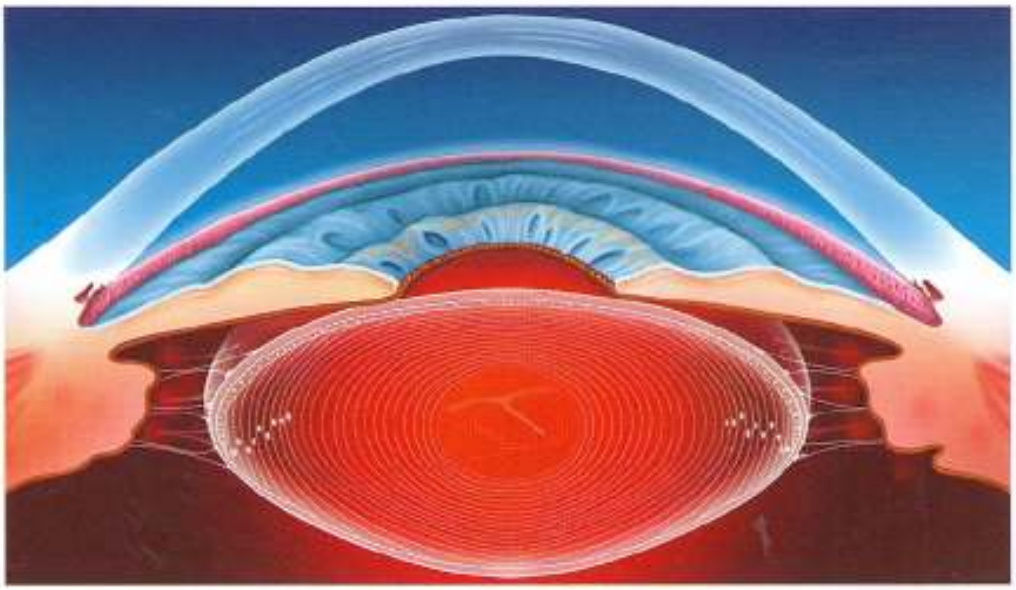


Figure 1-1 Cross section of the human crystalline lens, showing the relationship of the lens to surrounding ocular structures. *(Illustration by Christine Gralapp.)*

PICTURE 2

The optic axis is an imaginary line joining the anterior and posterior poles of the lens which passes through them. Meridians are lines on the surface which pass from one pole to the other . Equator of the lens is its greatest circumference[3].

Behind the anterior lens capsule is single layer of epithelial cells. These cells are metabolically active and carry out all the normal cell activities, including biosynthesis of RNA, DNA, protein, and lipid. They also generate ATP to meet energy demands of the lens. Epithelial cells are mitotic, the greatest activity of premitotic (replicative, S-phase) DNA synthesis occurring in a ring around the anterior lens known as the germinative zone.[3]

Biochemistry of the lens

Lens contains water soluble intracellular proteins Alfa and Beta crystallins. It contains urea soluble cytoskeletal proteins and urea insoluble most lens fiber cell membrane protein Major Intrinsic Protein (MIP).[4]

Goal of lens metabolism is to maintain transparency. Energy production largely depends on glucose metabolism.[4] Glucose is metabolised mainly via the sorbitol pathway, anaerobic glycolysis and hexose monophosphate (HMP) shunt pathway.[4]

Free radicals that are generated in the course of normal cellular metabolic activities may also be produced by external agents such as radiant energy. These free radicals which are highly reactive can lead to the damage of lens fibers .

Peroxidation of lens fiber plasma membrane lipids or of lens fiber plasma as been suggested as a factor contributing to lens opacification .[5]

Lens is equipped with several enzymes that protect against free radical or oxygen damage which include glutathione peroxidase, catalase, and superoxide dismutase.[5]

CATARACT SURGERY

The first documented treatment of cataract is couching (from the French verb coucher, "to put to bed") has a colorful history, starting from about the fifth century BC[6]. Couching was practiced in India, and its usage spread throughout the medieval Europe, Roman Empire and sub-Saharan Africa[7]

Figure 8-1 Couching. *(Reproduced from Duke-Elder S. Diseases of the Lens and Vitreous; Glaucoma and Hypotony. St Louis: Mosby; 1969.)*

PICTURE 3

Early Extracapsular Cataract Extraction

By 1600, opacification of the lens had become the new definition of cataract and anatomists had correctly identified the true position of the lens [8].

Jacques Daviel (l696-1762) is credited with propelling cataract surgery towards the modern era. He restricted his practice to ophthalmology, and his decision to remove the lens rather than displace the cataract was followed by the development of instruments to allow this revolutionary procedure[8]. In Jacques Daviel's method of cataract extraction,an incision was made through the inferior cornea and it was enlarged with scissors. The cornea was elevated, the lens capsule incised, the nucleus expressed, and than the cortex removed by curettage.[8]

In 1753 Samuel Sharp first performed a successful intracapsular cataract extraction (ICCE) , by removing a cataractous lens, capsule intact, through a limbal incision using pressure from his thumb.[8]

Albrecht von Graefe (1828- 1870) improved upon the Extracapsular technique by developing a knife that created a better-apposed incision. This innovation decreased the rate of uveal prolapse and infection.[8]

In relatively short order the binocular operating microscope, fine suture material and modern sterilization techniques increased surgical success and this reduced the number and severity of complications. [8]

ECCE involves the removal of the lens, nucleus and cortex through an opening in the anterior capsule, with the capsular bag being left in place. This technique has number of advantages over ICCE. Because it is performed through a smaller incision, it results in

- less trauma to the corneal endothelium

- less induced astigmatism

-a more stable and secure incision

-reduces the risk of intraoperative vitreous loss [8]

Posterior capsular opacification (PCO) is a common complication of cataract surgery with a (PCIOL) posterior chamber intraocular lens implantation. Its incidence varies from 7% to 31%, by 2 years postoperatively. Standard treatment procedure of PCO consists of making an opening in the central part of posterior capsule. Nd: YAG laser posterior Capsulotomy is the treatment of choice for the PCO.

The Nd: YAG lasing medium is a man-made crystal made of Neodymium doped yttrium-Aluminium-Garnet. It is a photo disrupter not a photo-coagulator like argon or krypton laser. In laser machines, emitted photons are reflected in highly polished mirrors forcing them to travel back & forth in the cavity. When a photon moves very close to an excited particle, this particle will be stimulated to emit a photon which is similar in wavelength, phase and spatial coherence to the first. This amplification continues, thus increasing the number of active photons.

The procedure is non-invasive, relatively safer, less time consuming and free from infection but has been associated with complications, which include

- raised intraocular pressure

-IOL pitting,

-cystoid macular oedema and

- retinal detachment.

Raised intraocular pressure remains to be one of the frequent complications of Nd: YAG laser capsulotomy. It is acute but transient. The efficacy of 0.5 % Timolol eye drops vs. 0.2% Brimonidine eye drops in monitoring rise in IOP following Nd-YAG Capsulotomy will be studied.

REVIEW OF LITERATURE

Posterior Capsule Opacification

Overall, the most common complication of cataract surgery by means of Phacoemulsification or conventional ECCE is opacification of the intact posterior capsule. In addition , with the introduction of continuous curvilinear capsulorrhexis PCO has been accompanied by fibrosis and anterior capsule contraction.[9]

Fortunately with the use of Nd:YAG laser posterior Capsulotomy posterior capsule opacification is amenable to treatment. Posterior Capsular opacification occurs from continued viability of Iens epithelial cells which are present in the anterior capsule . These cells proliferate in several patterns. Where the edges of the anterior capsule adheres to the posterior capsule, a closed space will be re-established consisting of nucleated bladder cells (Wedl cells), which result in a **Soemmering ring.**[9]

If the epithelial cells migrate outwards , **Elschnig pearls** which resemble fish eggs, are formed on the posterior capsule. These pearls can fill the pupil or remain behind the iris. Histopathology shows that each "fish egg" is a nucleated bladder cell, which is identical to those proliferating within the capsule of a Soemmering ring but which lies outside the capsule and usually lacks a basement membrane.

If the epithelial cells migrate across the anterior or posterior capsule, they may cause capsular wrinkling and opacification.[10] The lens epithelial cells are capable of undergoing metaplasia with conversion to myofibroblasts. Matrix of fibrous and basement membrane collagen can be produced by these cells, and contraction of collagen matrix will cause wrinkles in the posterior capsule, with resultant glare and distortion of vision.[10]

Meticulous cortical clean-up and hydrodissection are important preventive measures for reducing the likelihood of Posterior Capsule Opacification.[10]

Fibrosis presenting in the first few days to weeks after cataract surgery more often represents residual cortex which is left at the time of surgery . Fibrosis developing months to years after cataract surgery is caused by fibroblastic metaplasia, migration of epithelial cells of anterior lens capsule and collagen production[11] Heavy fibrosis can frequently occur at the edge of a PC-IOL placed in the capsular bag with the cohesion of anterior and posterior capsules. [11]

A posterior chamber lens tends to flatten broad wrinkles if the optic body presses on the capsule. Fibrotic contraction can also induce wrinkles.

Factors influencing this rate of PCO formation include

1. The age of the patient,

2. History of intraocular inflammation,

3. Presence of exfoliation syndrome,

4. Size of the capsulorrhexis,

5. Quality of cortical clean up,

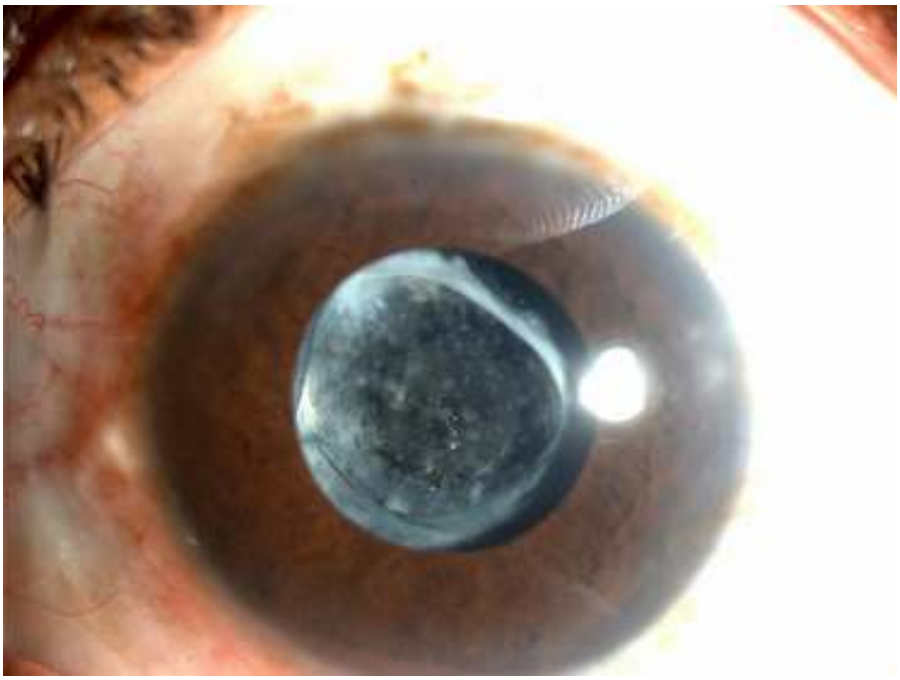
6. Capsular fixation of the implant,

7. Design of the lens implant (particularly a square edge optic design),

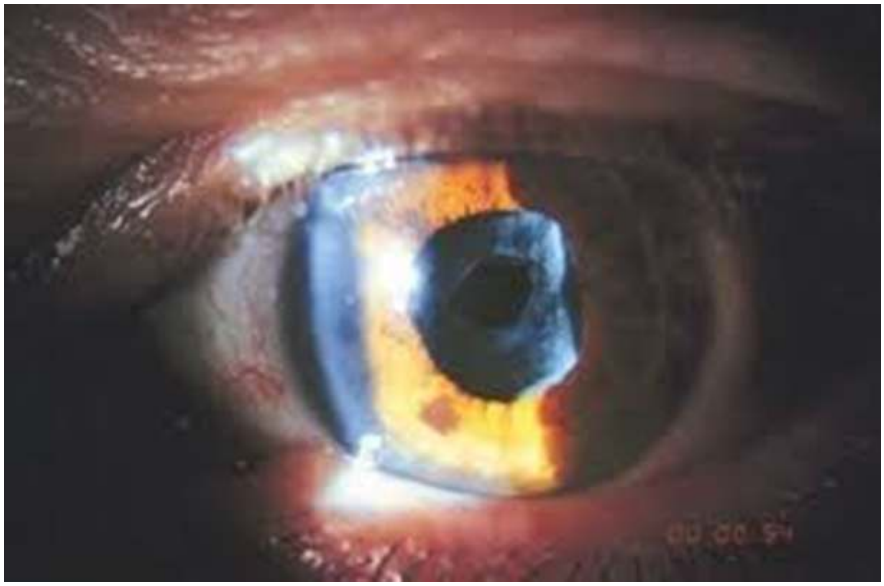
8. Modification of the lens surface,

9. Time elapsed since surgery

10. Intraocular silicone oil may dramatically speed the progression of opacity.[12]



PICTURE 4 - BEFORE ND YAG CAPSULOTOMY



PICTURE 5- Post ND YAG Capsulotomy

Hollick EJ et al[13] showed that occurance of posterior capsule opacification is shown to vary with different studies. Rates of posterior capsule opacification have been reported as 10–56% at 3 years with differing lens materials.

Auffarth GU et al [14] studied and reported that the occurance of posterior capsule opacification is lower if a meticulous cortical clean-up is performed.

Werner L et al [15] showed that square edge lens designs hydrophobic acrylic lenses have been found to decrease posterior capsule opacification by decreasing the migration of lens epithelial cells.

Chan RY et al [16] proved that mitotic inhibitors when injected into the anterior chamber after an ECCE have shown to reduce the incidence of PCO significantly .

Caporossi A, et al [10] concluded that attention to complete cortical clean-up and a meticulous hydro dissection are important preventive measures for reducing the likelihood of Posterior Capsule Opacification.[10]

Analysis of pooled multiple reports have found out that the visually significant posterior capsule opacification rate was found to be approximately 28% at 5 years.

Incidence of opacification at 3 years has been reported as **40% for silicone, 56% for polymethylmethacrylate, and 10% for acrylic material,** although the Nd:YAG rate is lower.[18]

Hollick EJ,et al [13] conducted a large post-mortem review and found the prevalence of Nd: YAG capsulotomy as **12%-21 %** for various **silicone IOLs**, **0.9% for acrylic IOLs** and **27%- 33%** for **polymethylmethacrylate** IOLs. Newer generation of silicone material appear to have a lower rate of Posterior Capsule opacification. It is now believed that this may be not due to the lens material but rather to the lens design and the quality of the capsular bend where the capsule overlaps the lens optic.[19]

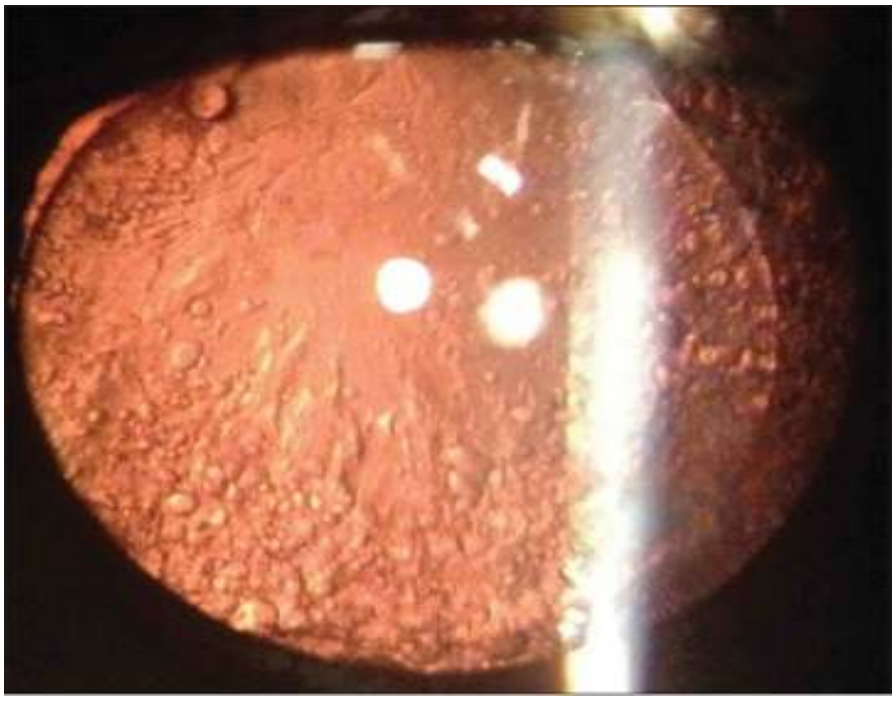


FIGURE 6- Elschnig Pearls

ND YAG LASER CAPSULOTOMY

Nd-Yag lasers are produced from a solid state crystal containing Neodymium Yttrium Aluminum Garnet. The YAG laser generates a beam of IR (infrared) light having a wavelength of 1064 nm which along with other optical elements fixes selected amount of energy, at the focal point which is around 11 microns with enough energy density to create a small plasma effect, which results in an acoustic wave that disrupts the surrounding tissue. This is described as the 'photo acoustic effect'.[17]

Uses

YAG LASERS are used in ophthalmology as photo-disruptors in in the following procedures:

• Posterior Capsulotomy for posterior capsule opacification after cataract surgery (after cataract).

• Pupillary membranectomy in both aphakic and pseudophakic patients.

• Iridotomy for glaucoma patients (PACG) .

The PCO (posterior capsular opacification) is the most common indication for the use of ND YAG laser .[17]

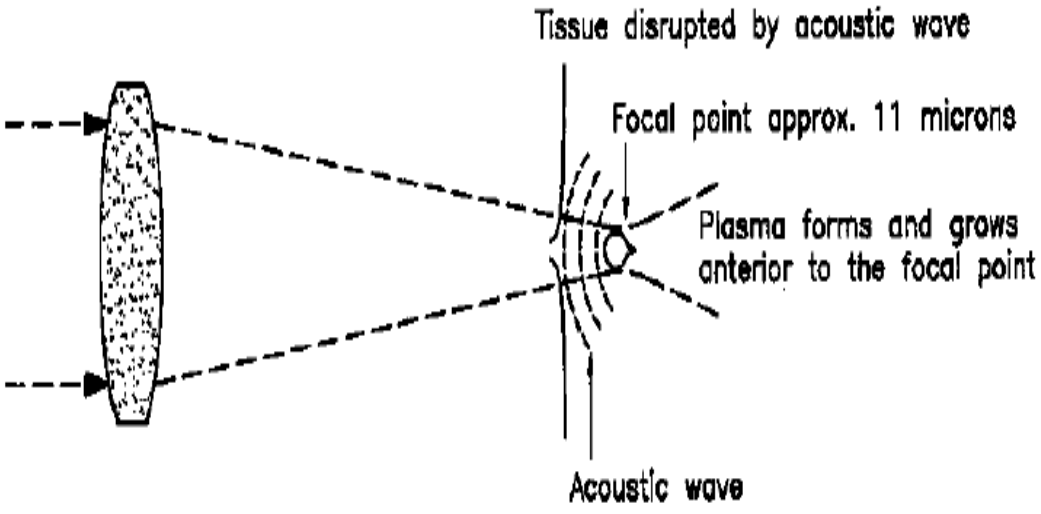
Principle

The high peak power pulse directed into the eye is due to the acoustic wave generated by the plasma . With the increase in energy the size of the plasma formed increases creating a stronger acoustic wave.

With an increasse in the energy it is important to focus the treatment beam further away i.e more posterior to the membrane which has to be penetrated.

This is very important in procedures such as a ND YAG posterior capsulotomy to:

(1) Prevent the chipping and cracking of the IOL caused by the plasma entering the IOL.



(2)

Figure 7 –Tissue disruption -acoustic wave

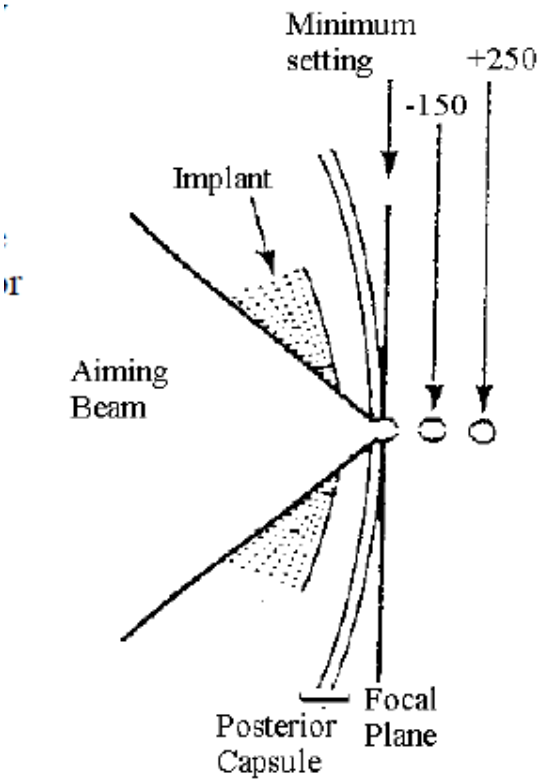


FIGURE 8

The image above shows the posterior counter balance of the Yag laser beam from the aiming beam:

2. To allow the shock wave to grow to its most effective size .[17]

When smaller amount of energy is used the focusing beam should be brought closer to the membrane.

NOTE: It is suggested to use the lowest possible energy to perform photodestrucive procedures like ND YAG Capsulotomy to minimize unwanted side effects like RD (Retinal Detachment) [17]

When the acoustic wave grows and moves into the eye care must be taken not to damage the IOL.

It is advisable to aim and focus the treatment laser beam posterior to the membrane to prevent damage to the IOL. Which is called "**posterior offset** " between the YAG laser treatment beam and the aiming beam .(Aiming beam is the beam which is visible and used to focus the laser at the treatment site.) [17]

Q-SWITCH:

Inside the lasing cavity is a small optic called the Q switch which is integrated part of it , it accumulates the energy within the cavity and lets it passout when it reaches a certain level.

With time the energy going out of the lasing cavity will progressively decrease and the Q-Switch will loose its performance and after a certain limit it gets useless and has to be changed.[17]

The 1st generation Q Switch had a short life time of 65000 shots due to the dust coming inside the cavity . They are chemical ones made of acetate and are unsealed . The sealing of the Acetate Q-Switch increased the life span of the cavity to 100,000 shots.

With the introduction of the new generation Super –Q ^{TM} the life span has increased to more than 450,000 shots, as Super Q^{TM} is an optical and not a chemical switch .[17]

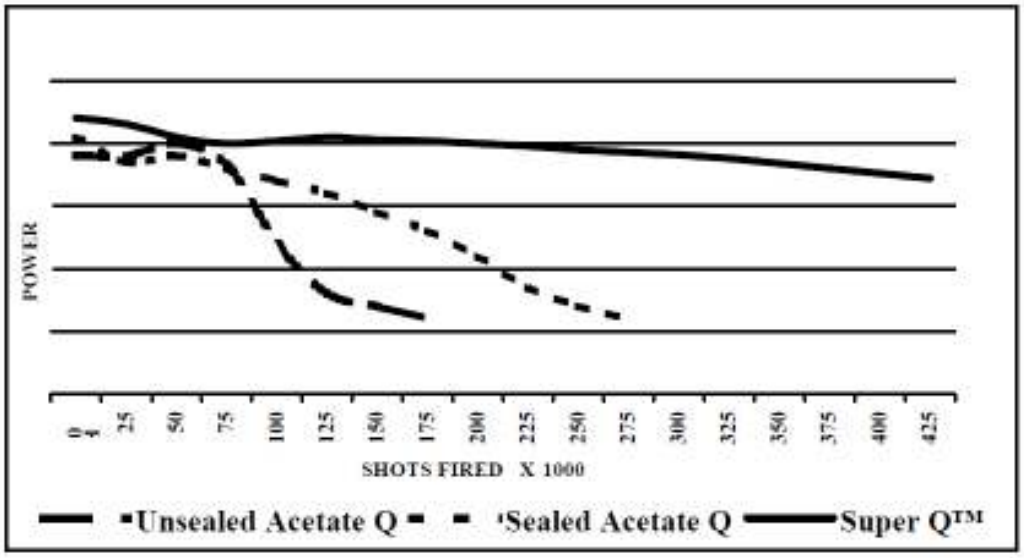


FIGURE 9

The chart above shows the lifespan of each of the Q-Switches.

INDICATIONS

The following are **indications** for Nd: YAG capsulotomy:[20]

1. Best -corrected visual acuity which has decreased significantly as a result of a hazy posterior capsule.

2. A hazy posterior capsule preventing the view of the ocular fundus required for therapeutic or diagnostic purposes.

3. Glare or monocular diplopia caused by posterior capsule wrinkling or by encroachment of a partially opened posterior capsule into the visual axis of a patient with an otherwise clear media and good visual acuity.

4. Contraction of anterior capsulotomy margins (capsular phimosis), which is causing alteration of the lens optic position or encroachment on the visual axis, requiring relaxing incisions[20]

FIGURE 10- Nd: YAG laser

FIGURE 11 - ABRAHAM'S LENS

Contraindications

The following are contraindications to Nd: YAG capsulotomy:

- inadequate visualization of the posterior capsule
- In an uncooperative patient who is unable to hold fixation or remain still during the procedure (use of retrobulbar anesthesia or a contact lens may enhance the feasibility of a capsulotomy in some of these patients)[20]

Procedure

Nd:YAG laser discission is usually a painless procedure and is performed as an outpatient procedure.

1.The surgeon first adjusts the oculars of the microscope-laser delivery system so that the focal point of the helium-neon aiming beam is clearly brought into focus.

2.The pulse energy threshold for puncture of the posterior capsule is generally 0.8-2.0 mj with either a mode-locked (30-200 ps pulse length) or a Q-switched (5- 30 ns pulse length) systems.

3.The surgeon should use the lowest effective energy output setting to puncture the posterior capsule,. Higher energy levels is required for areas of dense fibrosis.

4. Observation of the posterior capsule through an undilated pupil helps the surgeon to pinpoint the location of the visual axis, because the location of the visual axis may not be obvious through the dilated pupil.[20]

Centre of the visual axis is the desired site for the opening, which is adequate at 3-4 mm in diameter. In some circumstances,larger diameter openings may be required for complete visualization of the fundus. Dilation may be helpful in producing a larger opening in the posterior capsule.

5. A high -plus-power laser lens, used with topical anesthesia, improves the ocular stability and enlarges the cone angle of the beam, reducing the depth of focus. Smaller-focus diameter facilitates the laser pulse puncture of the capsule, and structures in front and behind the point of focus are less likely to be damaged . If light reflections from the slit-lamp illumination or the aiming beam obscure the area to be treated the patient can shift fixation, or the position of the bio microscope may be slightly adjusted.

Occasional reports of dislocation of IOL into the vitreous following capsulotomy have been of concern, particularly with silicone plate haptic lenses. [20]

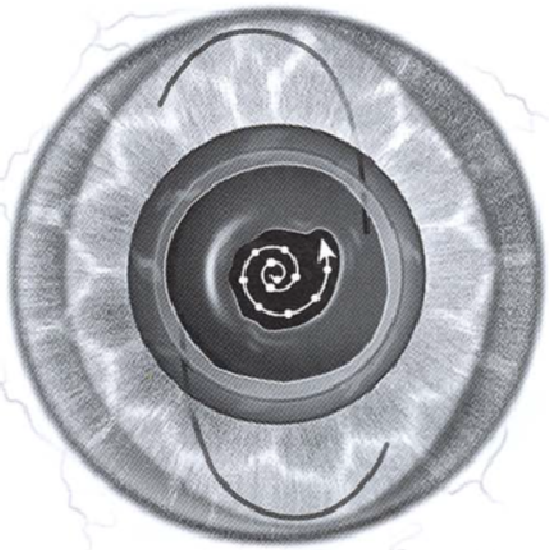


Figure 9-6 Making the series of laser punctures in a spiraling, rather than cruciate, pattern decreases the risk of radial tears. *(Illustration by Christine Gralapp.)*

FIGURE 12

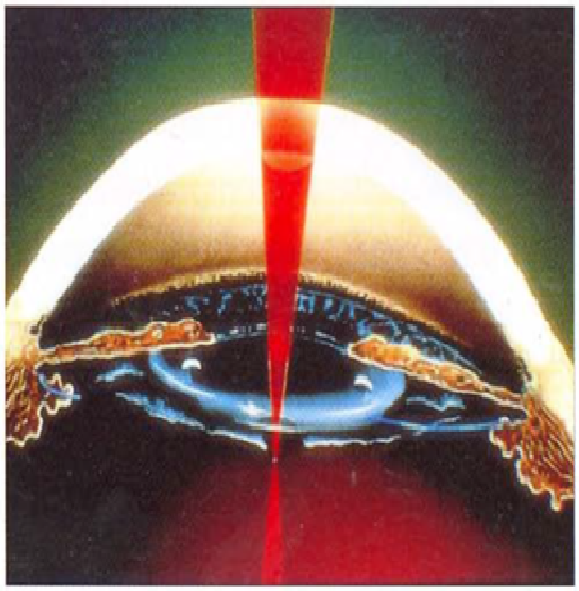


Figure 9-5 Enlarged cone angle of laser beam produces a narrower depth of field, facilitating laser pulse puncture of the capsule. *(Courtesy of Woodford S. Van Meter, MD.)*

FIGURE 13

6. Constructing capsulotomy in a spiralling circular pattern, rather than in a cruciate pattern, creates an opening less likely to extend radially and reduces the risk of dislocation.[20]

The anterior vitreous face may remain intact if the energy output applied is minimal The presence of a posterior chamber IOL will often keep in check ruptured anterior vitreous face , although vitreous strands occasionally migrate around the lens through the pupil.[20]

FIGURE 14 -ND YAG Capsulotomy being performed in a patient.

Posterior chamber IOL can be damaged by laser capsulotomy, but the threshold for lens damage appears to be lower for silicone when compared to other materials. Laser pulse should be focused just behind the posterior capsule, but pulses too far behind the IOL will be ineffective.

The safest approach is to focus the laser beam slightly behind the posterior surface of the capsule for the initial application and then move the subsequent applications anteriorly until the desired puncture is achieved. [20]

The surgeon should also search for sites where the capsule might have dropped more posterior to the IOL, because these sites can be treated more safely.

Multiple relaxing incisions of the fibrotic ring are applied in cases of anterior capsule contraction, to relieve the contracting force and create a larger optical opening. Anti -inflammatory drugs and Cycloplegic drugs are not routinely necessary. Preoperative and postoperative application of topical apraclonidine hydrochloride or Brimonidine tartrate is recommended to prevent postoperative IOP elevation.[20]

Rate of Nd:YAG is reported to be decreasing with the use of modern lens designs. The rates of capsulotomy have fallen to 0.9–17% compared with the rate of 20–33% in the 1980s and early 1990s.[18]

The success rate of Nd: YAG laser discission for opening the capsule appears to exceed 95%. Occasionally, thick and dense opacification is not affected by the Nd:YAG laser; these patients may require an invasive surgical procedure using a discission knife or scissors.[20]

Complications

Transient elevation of lOP appears in a significant number of patients and may be treated prophylactically with a topical alpha -adrenergic agent, with monitoring of post discission lOP.

Pressure levels peak within 2- 3 hours. This elevation appears to be the consequence of obstruction of the outflow pathways by debris or macromolecules scattered by the laser treatment.[21]

Elevations respond quickly to topical glaucoma medications, which are continued for 3- 5 days following the procedure. Special precautions should be taken to observe and treat patients with pre-existing glaucoma.[21]

Nd:YAG capsulotomy also increases the risk of retinal detachment. Approximately one half of the retinal detachments following cataract extraction occur within 1 year of capsulotomy,which are often associated with a posterior vitreous detachment

In many cases, it is very difficult to ascertain whether the retinal detachment is related to the capsulotomy or to the cataract surgery itself. A family history of retinal detachment, high myopia, vitreous trauma, and pre-existing pathology are risk factors that increase the risk of retinal detachment following Nd: YAG capsulotomy.[21]

CME can also occur following Nd:YAG capsulotomy. In patients with a history of CME, or in high-risk patients such as those with diabetic retinopathy, the use of topical steroids and nonsteroidal anti-inflammatory agents (pre treatment and post treatment may be beneficial.)

The risk of CME and retinal detachment may be greater when Nd:YAG capsulotomy is performed within 6 months of cataract surgery.[21]

The implant can dislocate into the vitreous cavity following capsulotomy. This can occur with plate haptic silicone implants (those with smaller fenestrations) than with any other types of IOL.

When a plate haptic silicone lens is present Nd:YAG capsulotomy should be delayed for 3 months to increase the likelihood of capsular fixation.[21]

New modifications in lens design and materials, future improvements in surgical technique, and someday perhaps pharmacologic intervention can offer an opportunity for further reduction of posterior capsule opacification .

Although with modern Nd:YAG capsulotomy the incidence of complications is small, a zero percent opacification rate is the ultimate surgical goal.[21]

The causes of decreased vision following ND YAG capsulotomy include, CME[23] , increased IOP[22], RD[24], IOL damage,[25] endophthalmitis,[26] iritis[27].

Rarely it results in significant vision threating IOP rise in aphakic and pseudophakics .[28]

Keates RH et al found out that both worsening of preexisting glaucoma and new onset glaucoma can occur . Patients having glaucoma previously are susceptible to a rise in IOP.[29]

Demer JL et al confirmed that the rise in IOP which is typically transient may ocasionally persist and rise in IOP occurs in the first 2 hrs after the procedure .[30]

Altamirano D, et al found out that Nd:YAG capsulotomy leads to reduction in the aqueous outflow by the obstruction of the trabecular meshwork by inflammatory cells, capsular particles, ,and protein and by producing prostaglandin-mediated effects.[31]

Steinert RF et al concluded that the total energy delivered and number of laser pulses do not have any association with the rise in IOP [23].

Chen TC et al found that in patients subjected to Nd: YAG capsulotomy close observation was required to treat postoperative intra ocular pressure elevation. Topical brimonidine and apraclonidine are very effective in preventing acute IOP spikes following Nd: YAG laser treatment.[32]

Richter CU et al studied that capsulotomy is associated with increased IOP in normal eyes years after the procedure has been completed.[28]

Ari S, Cingü et al reported that increased macular thickness and IOP occur after Nd:YAG laser capsulotomy, but the duration and severity are low when the energy was below 80 mJ . [33]

Tranos P et al concluded that transient acute elevations of IOP (spikes) can occur following many surgical and laser procedures like Nd-YAG peripheral iridotomy or capsulotomy.[34]

The study done by **Wasserman EL et** al showed that the average IOP rise was 1.4 mm Hg occurring within 1 hour of ND YAG Capsulotomy. The average corneal endothelial cell loss of 7% or 115 cells/mm2. Visual acuity(VA) improved in 87.5% of patients to better than 20/30.[35]

The study done by **Keates RH, et al** concluded that in the laser-treated population the aggregate complication rates were very low (retinal detachment 0.4%, secondary glaucoma 3.6%, CME 2.3%,, overall rate 4.8%). Persistent complications (after 6 months postoperative period) were present at an incidence of 2.3%, comprising of secondary glaucoma, 0.8%.- retinal detachment, 0.2%,- CME , 5.7% of subjects had an IOP rise of 30 mm Hg or greater. The IOP normalised within the first 24 hours to one week in 89% of subjects.

IOP rise of 30 mm Hg or greater was seen in patients with IOP greater than 20mm hg and in patients with preoperative glaucoma .[29]

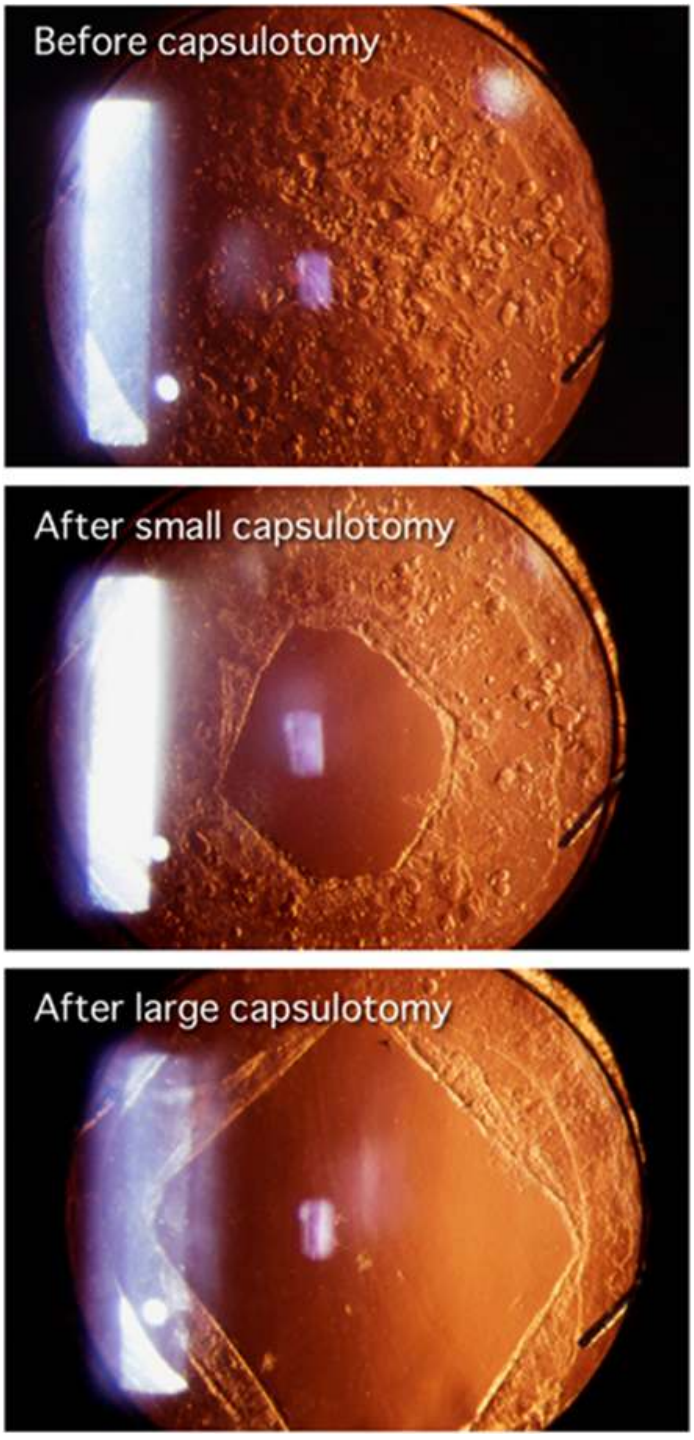

Before capsulotomy
After small capsulotomy
After large capsulotomy

FIGURE 15

Ge J, et al found out that the rise in IOP in long term basis was related significantly to the IOP increase which occurred 1 hour after ND YAG capsulotomy (P =. 001). Patients having glaucoma required long-term additional glaucoma medication than non glaucoma patients after the capsulotomy (P =.002).[36]

Lin JC, et al conducted a study in glaucoma patients and started the patients on aggressive glaucoma medication and concluded that it was unclear wheather progression of glaucoma was related directly to Yag capsulotomy or whether it was an independent progression of glaucoma unrelated to YAG Capsulotomy.[37]

A study done by **Zeyen P et al** evaluated the long term effects of YAG capsulotomy on IOP after combined glaucoma and cataract surgery. They retrospectively studied 20 patients who underwent posterior capsulotomy after single-site combined phacoemulsification and trabeculectomy. They assessed the number of glaucoma medications and mean IOP . The mean follow-up was 3 months (range 1 to 6 months). Mean IOP's remained almost unchanged, and were 13.9 +/- 2.7 before and 14.8 +/- 3 mmHg after capsulotomy (p = 0.115). They concluded that Yag laser posterior capsulotomy does not significantly affect glaucoma medication use or bleb function in patients who underwent combined phacoemulsification and trabeculectomy. [38]

TIMOLOL

Timolol is a non selective beta blocker also known as beta adrenergic antagonist . It lowers the lOP by reducing aqueous humor production by as much as 50% .It is likely that the Ciliary body is the site of action, it is not known which is primarily affected: the pumping mechanism of the ciliary epithelium or the vasculature of the ciliary processes . One mechanism may be an effect on the Ciliary epithelium's beta adrenergic receptor-coupled adenylate cyclase. Systemic administration of beta blockers is known to elevate blood lipid . Such elevation has not been seen with topical beta blockers such as timolol.[39]

All the beta blockers can inhibit the increase in blood pressure and pulse which is exhibited in response to exertion. For this reason. they are poorly tolerated in elderly patients during the routine activities and in young, physically active individuals. Nonselective beta blockers will inhibit the pulmonary beta receptors that dilates the respiratory tree. The bronchospasm which induced may be significant in patients with chronic obstructive lung disease and asthma .

In patients with second-degree or third-degree atrioventricular block, heart failure and bradycardia the underlying cardiac condition can be exacerbated with use of these agents. Timolol maleate 0.25% or 0.5% is a mixed beta 1 and 2 – antagonist. [39]

Both levobunolol and timolol are non selective b-blockers (i.e. they bind b1- and b2-receptors with nearly equal affinity). Betaxolol is selective for the b1-receptor. Carteolol has been introduced into the medical treatment of glaucoma recently. It is a nonselective b-blocker with intrinsic sympathomimetic activity (ISA). B-blockers have a tendency to cause cardiovascular and respiratory problems[39]

The selectivity of a b-blocker for b2 or b1--receptors would make it a better choice for patients with asthma and cardiovascular insufficiency, respectively.

At therapeutic concentrations the drugs currently used do not have a selectivity sufficient to prevent their binding of all b-receptors.[39]

Timoptic-XE (a timolol formulation which forms a gel on coming in contact with the ocular surface) given once a day was seen to be as effective in lowering IOP as the equivalent concentration of topical timolol given twice a day. The safety profile is also similar to that of equivalent concentrations of timolol. [40]

As of 1985, the National Registry for Drug-Induced Ocular Side Effects and US Food and Drug Administration have tabulated a total of 450 case reports of serious respiratory or cardiovascular complications, 32 of which resulted in death, after administration of timolol topically . Of the 212 patients for which a medical history was provided, 92% had either respiratory or cardiovascular problems.[41]

Beta -blockers should not be used in combination with CCB (calcium channel blockers) , as sudden death has been reported after the systemic administration of a b-blocker with verapamil. [42]

b-Blockers can cause bronchial constriction by binding to b2-receptors in the bronchi. Nonselective b-blockers (such as timolol) may compromise ventilation in patients with asthma ,obstructive lung disease, or bronchospasm.[43]

The National Registry for Drug-Induced Ocular Side Effects has received over 200 reports of respiratory problems induced by topical timolol.. 16 fatal attacks of status asthmaticus have occurred with the application of topical timolol.[43]

Cai JP, Cheng JW et al studied the prophylactic use of topical 0.5 % timolol maleate eyedrops to prevent IOP elevation after Nd-YAG laser posterior capsulotomy .[44]

190 eyes of 184 patients who had Nd-YAG laser posterior capsulotomy for posterior capsular opacification were divided into 2 grops first being patients undergoing pretreatment with topical 0.5 % Timolol maleate i.e.the treatment group and placebo i.e. the control group [44]

RESULTS:

The mean IOP of the treatment group was found to be 14.8+/-3.0 mmHg before Yag laser capsulotomy and 15.7+/-3.4 mmHg after YAG capsulotomy ($P>0.05$), whereas IOP was 15.1+/-3.3 mmHg and 17. 2+/-4.3 mmHg ($P<0.05$) for the control group. There was statistically no significant difference between the two groups with regard to mean intraocular pressure(IOP)before capsulotomy ($P>0.05$), but a statistically significant difference was seen between the two groups after capsulotomy ($P<0.05$). 6 of 91 eyes (6.6%, two with aphakia) in the treatment group had an intraocular pressure elevation greater than 6 mmHg compared with 14 of 99 eyes (14.1%, eight with aphakia) in the control group ($P<0.01$).44

CONCLUSION:

Pre-treatment of the patients before ND YAG apsulotomy with a topical 0.5% timolol maleate was effective in preventing the rise in intraocular pressure after Nd-YAG laser posterior Capsulotomy[44]

Boen-Tan TN et al studied the prevention of intraocular pressure rise after Nd-YAG laser capsulotomy for PCO with 1 tablet acetazolamide 250 mg orally and topical timolol eye-drops pre-operatively .[45]

In this study the intraocular pressure (IOP) of 10 pseudophakic patients in 3 groups undergoing Nd-YAG laser posterior capsulotomy was measured before YAG capsulotomy and 2 and 4 hours after the procedure , in the study the fellow-eye was used as control. The 1st group did not receive medication, the 2nd group received topical timolol 0.5% eyedrops before the procedure , the 3rd group received both 1 tablet of acetazolamide 250 mg systemically and topical timolol 0.5%. Pretreatment with 0.5% topical timolol reduces intraocular pressure rise but it does not give complete protection. The combination of 1 tablet of acetazolamide 250 mg with timolol 0.5% proved to be a safer procedure for the prevention of IOP-rise after YAG laser capsulotomy. To prevent the other complications it is better to make a smaller capsulotomy of 2-3 mm diameter using as little energy as possible. The presence of a defocusing system in the laser is of great advantage. Indomethacin eye drops given for a period of 6- 8 weeks after the procedure is effective in preventing cystoid macular edema.[45]

Richter CU et al compared the pretreatment with 0.5% Timolol eye drops and placebo in managing the rise in IOP following ND YAG capsulotomy. Patients treated with 0.5% Timolol eye drops did not have significant IOP elevation while placebo group had IOP elevation of 5 mm Hg or more. Aphakic patients pretreated with 0.5 % Timolol eye drops developed a maximum IOP rise of 40 mm Hg . they concluded that pretreatment with topical 0.5% Timol after ND YAG capsulotomy provided a partial protection from IOP elevation .[46]

BRIMONIDINE

Brimonidine tartrate is an alpha 2 adrenergic agonist which prevents release of norepinephrine at nerve terminals. It improves trabecular outtlow and decreases aqueous production as well as episcleral venous pressure. Its true ocular hypotensive mechanism is not fully understood. When it is administered pre- and postoperatively, Brimonidine is effective in diminishing the acute lOP rise following Nd:YAG laser capsulotomy ,argon laser iridectomy and argon laser trabeculoplasty. Apraclonidine hydrochloride can be used for the short-term lowering of lOP, but the development of tachyphylaxis and topical sensitivity often limits its long- term use.[47]

Brimonidine causes lesser tachyphylaxis than apraclonidine in long-term use and the rate of allergic reactions, such as contact blepharodermatitis, and follicular conjunctivitis is also lower (up to 40% for apraclonidine but < 15% for brimonidine).

Cross-sensitivity to brimonidine eye drops in patients with known hypersensitivity to apraclonidine is usually minimal. Brimonidine's mechanism of lowering lOP is thought to involve both decreased aqueous production and increased uveoscleral outflow .

Similar to the case with topical beta-blockers, a central mechanism may also account for part of the lOP reduction from brimonidine 0.2% eye drpos .

A week long trial of treatment for a Single eye caused a statistically significant reduction in the IOP of 1.2 mm Hg in the fellow eye[47]

Brimonidine's peak intraocular pressure (lOP) reduction is approximately 26% (2 hours after the dose). At its peak, brimonidine's action is comparable to a nonselective beta blocker and it is superior to the selective beta blocker like betaxolol , while at its trough (12 hours post dose), the reduction in IOP is only 14%-15%, which makes brimonidine eye drops at its trough less effective than the nonselective beta blocker but comparable to betaxolol. Brimonidine has potential neuroprotective properties which was proved in animal models of optic nerve and retinal injury that are independent of IOP reduction.[47]

The mechanism of neuroprotection by brimonidine is up-regulation of basic fibroblast growth factor, a neurotrophin, and cellular regulatory genes. Caution is recommended when using brimonidine or apraclonidine in patients on tricyclic antidepressants(TCA) or MAO inhibitor therapy and in patients with cardiovascular disease.

Prudence is required while using these drugs concomitantly with antihypertensives, beta blockers, and cardiac glycosides (ophthalmic and systemic) . Though effective in acutely lowering the lOP in patients with angle-closure glaucoma, these drugs also induce vasoconstriction which can prolong iris-sphincter ischemia and reduce the efficacy of concurrent miotics. Apraclonidine has a greater affinity for alpha 1-receptors than brimonidine and therefore more likely to produce vasoconstriction in the eye. Brimonidine does not induce vasoconstriction in the optic nerve or posterior segment. The ligand binding to alpha 2-receptor in other systems mediates inhibition of the enzyme adenylate cyclase. Adenylate cyclase which is present in the Ciliary epithelium has a role in aqueous production.[47]

Pollack IP et al studied the the use of topical 1% apraclonidine in preventing the rise in IOP following ND YAG capsuolotomy.

A multicentered prospective double-masked study was conducted in which , 63 eyes were treated with placebo or 1 drop of either 1% apraclonidine hydrochloride 1 hour before Yag Posterior Capsulotomy and after the procedure.

Rise in intraocular pressure in the placebo group occurred in the 3rd hour after Yag Posterior Capsulotomy , when the mean IOP(intraocular pressure) increased from a baseline pressure of 16.4 +/- 3.7 to 20.8 +/- 6.8 mm Hg. In topical apraclonidine-treated eyes, the (intraocular pressure) IOP dropped from a mean of 15.6 +/- 3.8 to 12.8 +/- 6.0 mm Hg within 3 hours postoperatively. There were 5 times as many eyes having an intraocular pressure increase of more than 10 mm Hg in the placebo group compared with those treated with topical apraclonidine. Topical apraclonidine was shown to be very effective in preventing the rise in intraocular pressure following YPC – Yag Posterior Capsulotomy .

Gartaganis SP et al studied the prevention of IOP elevation following ND YAG capsulotomy with the usage of topical brimonidine eye drops .[49]

A placebo-controlled, double-masked, randomized, clinical study in 60 patients who had undergone YAG capsulotomy after ECCE. 2 doses of placebo or topical Brimonidine were given before and after the procedure . IOP was moniterd before instillation of drug and 48 hrs after the procedure .[49]

RESULTS:

After ND YAG capsulotomy, the topical Brimonidine group had showed a significant reduction in intraocular pressure, while placebo group showed a significant mean increase in intraocular pressure. After 48 hours IOP of both groups returned to prelaser values. There was no significant differences in adverse effects in both groups .[49]

CONCLUSION:

2 doses of topical 0.2% Brimonidine eye drops prevents the IOP rise after YAG laser capsulotomy .[49]

Simsek S et al studied the use of 0.25% topical apraclonidine eye drops in preventing IOP rise after Nd:YAG laser capsulotomy [50] . The adverse effects and efficacy of 0.25% apraclonidine on IOP after YAG laser capsulotomy was investigated, the results were compared with 0.50% timolol maleate, placebo, and 1% apraclonidine.[50]

METHODS:

80 eyes were randomly assigned to 4 groups of 20 eyes. In a double-masked design, the patients in groups were treated with placebo (group 1), 0.50% timolol maleate (group 2), 1% apraclonidine (group 3), 0.25% apraclonidine (group 4) 1 hour before and 5 minutes after Nd:YAG laser posterior capsulotomy. IOP (intraocular pressure) was measured by AT (applanation tonometry) 1 hour before (baseline IOP) and one . three, twenty four hours after capsulotomy.[50]

RESULTS:

Average baseline IOP (intraocular pressure) significantly increased respectively 3.90 +/- 5.35, 5.95 +/- 5.32, 1.15 +/- 3.20 mmHg in the first group 1, 3 and 24 hours post-treatment.

Significant differences between baseline IOP and one and three hours but not at 24 hours (p = 0.004, p = 0.001, p = 0.13). IOP (intraocular pressure) increased 0.40 +/- 4.08, 0.75 +/- 5.33, 0.80 +/- 6.03 mmHg in the 2nd group at the same times. Differences between average baseline IOP (intraocular pressure) and the 1, 3 and 24 hr measurements were not significant (p = 0.83, p = 0.65, p = 0.93). In the 3rd d group, IOP (intraocular pressure) significantly decreased 3.70 +/- 2.40, 3.30 +/- 2.47, 2.65 +/- 1.56 mmHg at the measurement times, with significant differences between the average baseline IOP and the 1, 3 and 24 hour measurements (p = 0.001, p = 0.0001, p = 0.01). In the fourth group IOP increased significantly 0.35 +/- 3.32 mm Hg at 1 hour, but decreased 1.25 +/- 3.41, 0.90 +/- 2.07 mmHg at 3 and 24 hours.

Differences were not significant (p = 0.94, p = 0.16, p = 0.08). There were significant differences when the topical 0.25% and 1% apraclonidine groups were compared, between the average IOP (intraocular pressure) at 1 hour in both groups but not at 3 and 24 hours (p = 0.01, p = 0.17, p = 0.21).

Similarly, no significant differences were there between the average intraocular pressure at same times when the topical 0.25% apraclonidine group was compared with the topical timolol group ($p = 0.30$, $p = 0.08$, $p = 0.16$). Some local and systemic side effects were seen in the topical timolol and topical 1% apraclonidine groups, but none with topical 0.25% apraclonidine group .[50]

CONCLUSIONS:

Hence it was deduced that topical 0.25% apraclonidine eye drops is effective in preventing the early elevation of intraocular pressure after Nd:YAG laser capsulotomy and can be used as an alternative to topical 0.50% timolol maleate and topical 1% apraclonidine. [50]

FIGURE 16 - Applanation Tonometry being performed in a patient

FIGURE – 17 Pachymetry being performed to measure the central corneal thickness and measure the corrected IOP.

AIM OF THE STUDY

A Study to compare the efficacy of 0.5 % Timolol eye drop's vs. 0.2% Brimonidine eye drops in management of rise in Intra Ocular Pressure following neodymium-yttrium aluminium garnet (YAG) capsulotomy for Posterior Capsular Opacification.

OBJECTIVES

1. To measure the rise in IOP following Nd: YAG capsulotomy.

2. To measure the effect of 0.5% Timolol in management of rise in IOP following Nd: YAG Capsulotomy.

3. To measure the effect of 0.2% Brimonide in management of rise in IOP following Nd: YAG Capsulotomy.

4. To compare the efficacy of 0.5 % Timolol eye drop's vs. 0.2% Brimonidine eye drops management of rise in IOP following Nd: YAG Capsulotomy.

MATERIALS AND METHODS

STUDY DESIGN

Open-label, Randomized hospital based study.

SETTING

The study was conducted in the Ophthalmology Department of Coimbatore Medical College Hospital which is a tertiary care Hospital and Major reference centre getting adequate number of PCO cases**.**

DURATION OF STUDY

From August 2013 – July 2014

STUDY POPULATION

Patients in the age group between 40 to 70 years having posterior capsular opacification visiting the Out Patient in the Department of Ophthalmology of Coimbatore Medical College Hospital.

CASE SELECTION

Patients who had undergone cataract surgery with posterior chamber IOLs having poor vision due to PCO . Who have had a cataract surgery more than 6 months.

1. Informed consent was taken from patients undergoing Nd: YAG laser posterior capsulotomy.

2. Subjects consenting to take part in the study were matched in terms of age and sex.

3. An increase in IOP of >5 mmHg from the baseline (prelaser capsulotomy) after Nd: YAG capsulotomy was termed as having '**raised IOP'**.

4. Energy used in this procedure was termed as 'low energy' if it was less than 30 mJ and **'high energy'** if it was > 30 mJ.

Sample Size –100 patients with PCO(Posterior Capsular Opacification) was studied for post ND: YAG laser rise in IOP. The patient not having any organic cause of decreased vision and who have completed at least 6 months after cataract surgery were selected.

50 of these patients were given 1 drop of 0.5% Timolol eye drops 1 hour before the procedure and I drop after the procedure and were advised to use 0.5 % Timolol eye drops twice a day for the next 7 days . The remaining 50 of these patients are given 1 drop of 0.2% Brimonidine eye drops 1 hour before the procedure and I drop after the procedure and were advised to use 0.2% Brimonidine eye drops twice a day for the next 7 days .

INCLUSION CRITERIA

1. Pseudophakes with posterior chamber IOLs having poor vision due to PCO (Non-glaucomatous subjects).

EXCLUSION CRITERIA

1. Corneal diseases with hazy media

2. Inflammatory eye diseases,

3. Glaucoma

4. Less than 6 months post cataract surgery

5. Posterior segment surgery

6. Trabeculectomy

7. Macular oedema/ maculopathy

8. High Myopia more than 6 D

9. Patients having Asthma, COPD and Cardiovascular diseases were excluded from the study.

The Name, age, gender, address and contact number of all the selected patients having PCO, was entered in the specially designed proforma**.**

Before performing Nd: YAG laser posterior capsulotomy, all patients underwent a thorough ophthalmic evaluation including the

1. Best corrected visual acuity, (BCVA)

2. Slit lamp examination,

3. IOP measurement by Goldmann Applanation tonometer, and NCT

4. Detailed fundus examination to rule out any pre-existing pathology.

5. The measurement of pre-laser IOP will be entered in the proforma

The pupil was dilated with 1% tropicamide eye drops.

- 1 drop of 0.5%Timolol eye drops was instilled in 50 patients 1 hour before Nd: Yag Capsulotomy.

- 1 drop of 0.2 % Brimonidine eye drops was instilled in 50 patients 1 hour before Nd: Yag Capsulotomy.

- Proparacaine hydrochloride eye drops was used for topical anaesthesia, one drop 1-2 times about 2-3 minutes before applying contact lens (ABRAHAM LENS).

-Nd: YAG laser (APPA YAG LASER) was used for capsulotomy.

- The power in mj and the number of shots was individualised for each patient based on the thickness of PCO.

- An opening of 3-4 mm was made in the posterior capsule by o**ne single consultant ophthalmologist**, using minimum possible pulses of Nd: YAG laser,

- The total amount of energy used in YAG laser capsulotomy procedure was noted, as viewed on the control display panel of Nd: YAG laser machine, and was recorded in the proforma.

- 1 drop of 0.2 % Brimonidine eye drops was instilled in 50 patients following the procedure. The patients in the Brimonidine group were advised to apply 0.2% Brimonidine eye drops twice a day for 7 days after the procedure.

-1 drop of 0.5%Timolol eye drops was instilled in 50 patients of the 2nd comparision group following the procedure. The patients in the Timolol group were advised to apply 0.5% Timolol eye drops twice a day for 7 days after the procedure.

- The IOP was measured 1 hour, 4 hours, 3rd day, and 7th day following the procedure and entered in the proforma.

-Pachymetery was used to measure the central corneal thickness and the corrected IOP was measured 1 hour, 4 hours, 3rd day, and 7th day following the procedure and entered in the proforma.

STATISTICS

Unpaired t-test was used for comparison of above mentioned quantitative variables between low and high energy categories.

Qualitative response variables such as raised and normal IOP and sex will be presented by frequencies and percentages.

Chi-square test will be applied to compare proportions of patients having reduction in IOP with 0.5% Timolol after Nd: YAG laser posterior capsulotomy will be computed.

Chi-square test will be applied to compare proportions of patients having reduction in IOP with 0.2 % Brimonidine after Nd: YAG laser posterior capsulotomy will be computed.

Correlation between 'raised IOP' and energy used will be determined by correlation co-efficient and will be presented in scatter diagram. **P-value <= 0.05** will be considered as statistically significant result.

SIGNIFICANCE OF THE PROJECT

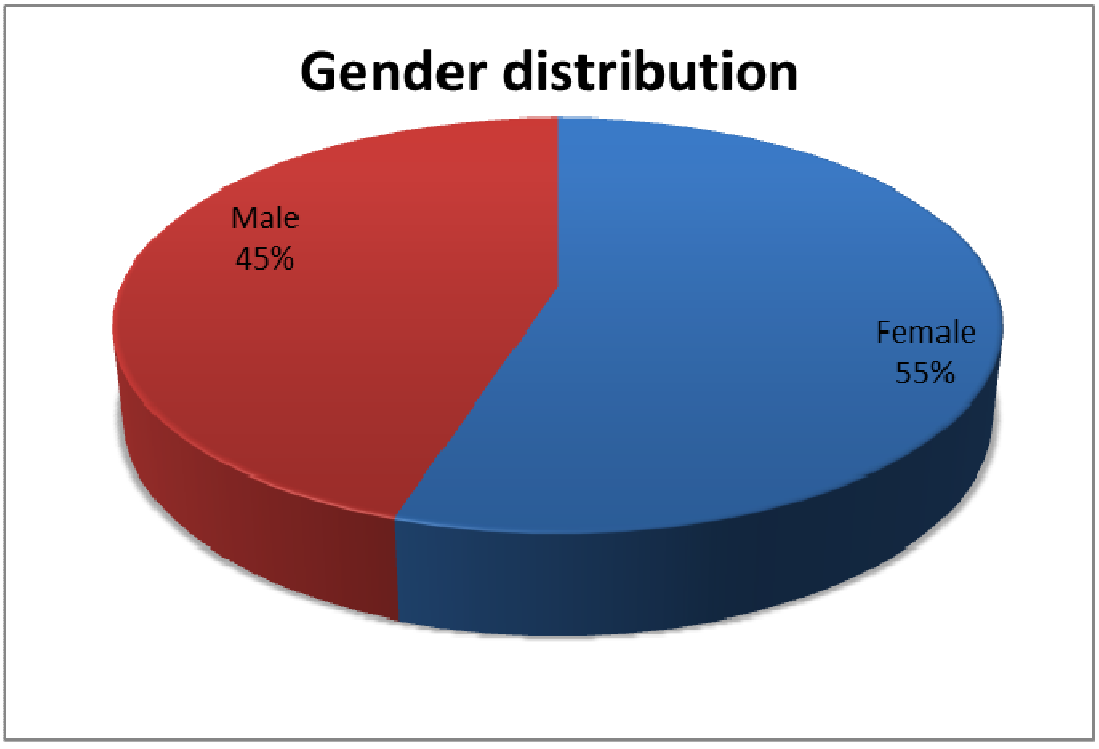
Posterior capsular opacification (PCO) also known as after cataract is a frequent post-surgical complication which follows phacoemulsification or non-phacoemulsification cataract surgery with posterior chamber intraocular lens implantation.

The term **posterior capsular opacification** is a misnomer. The opaque membrane develops as a result of retained cells proliferating and migrating on the surface of the posterior capsule and it is not the capsule which opacifies. Till today ND: YAG laser capsulotomy has been the ultimate choice to for the treatment of PCO . Rise in IOP (intraocular pressure) is a transient and significant complication of this procedure.The study compares the efficacy of 0.5 % Timolol eye drop's vs. 0.2% Brimonidine eye drops in management of rise in Intra Ocular Pressure following neodymium-yttrium aluminium garnet (YAG) capsulotomy for Posterior Capsular Opacification.

RESULTS AND OBSERVATION

The collected data was analysed with **SPSS 16.0 version**. To describe about the data descriptive statistics ,frequency analysis, percentage analysis were used for categorical variables and for continuous variables the mean and S.D were used. For Independent groups (Timilol & Brimonidine) Independent t-test was used. For the repeated measures (IOP –1 hr Prior ,Hour 1,Hour 4,Day 3 & Day 7) the Repeated measures of ANOVA with adjustment for multiple comparisons to control the type I error, the **Bonferroni test** was used.To assess the relationship between the variables **Pearson's Correaltion** was used.To find the significance in categorical data **Chi-Square test** was used. In all the above statistical tools the probability value .**05 is considered as significant level**.

CHART 1



Among the 100 patients selected randomly for the study 45 were males and remaining 55 were females.

Descriptive Statistics

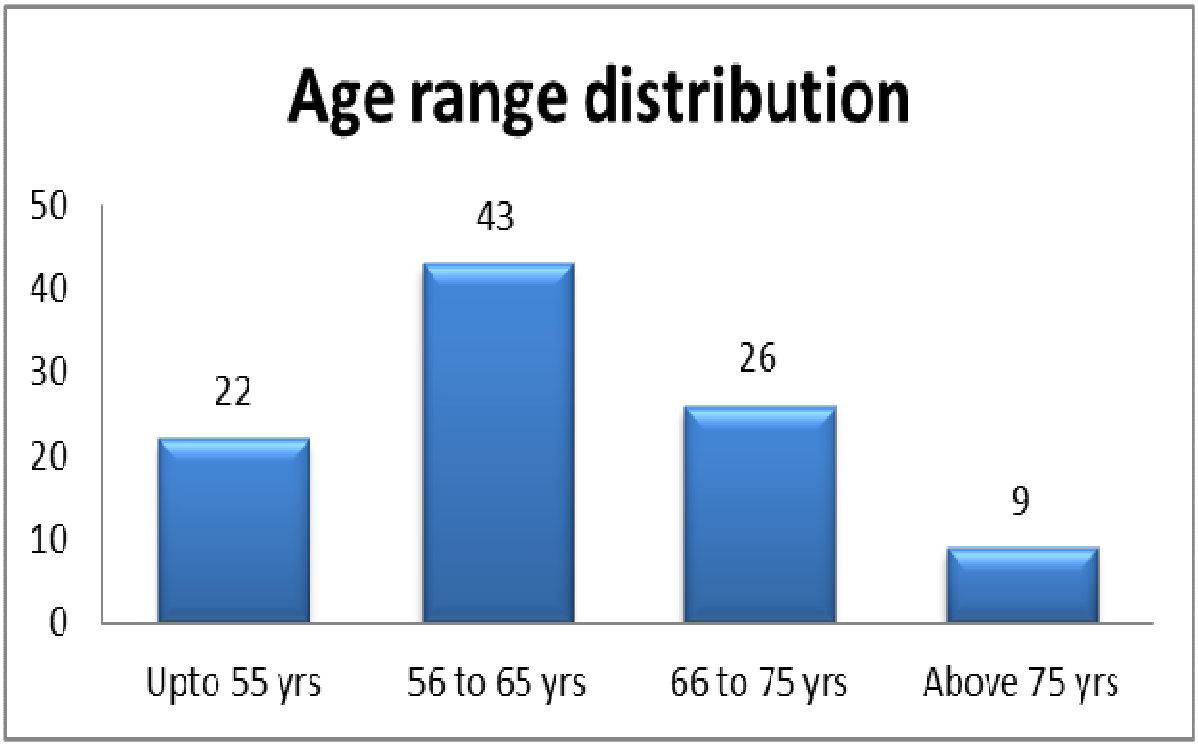
TABLE NO : 1

	Frequency	Percent	Valid Percent	Cumulative Percent
Female	**55**	**55.0**	**55.0**	**55.0**
Male	**45**	**45.0**	**45.0**	**100.0**
Total	**100**	**100.0**	**100.0**	**100.0**

AGE WISE DISTRIBUTION

Among the 100 patients selected for the study 22 of the were between the age group of 40-55 years , 43 patients were in the age group of 56- 65 years , 26 patients were in the age group of 66 to 75 years and 9 of the patients were above 75 years.

CHART 2



The descriptive statistics i.e. , frequency analysis for this study revealed that the minimum age of the patient selected for the study was 40 years and maximum age was 83 years the mean for the 100 patients was calculated as 63.19 and the standard deviation from the mean was noted as 9.530

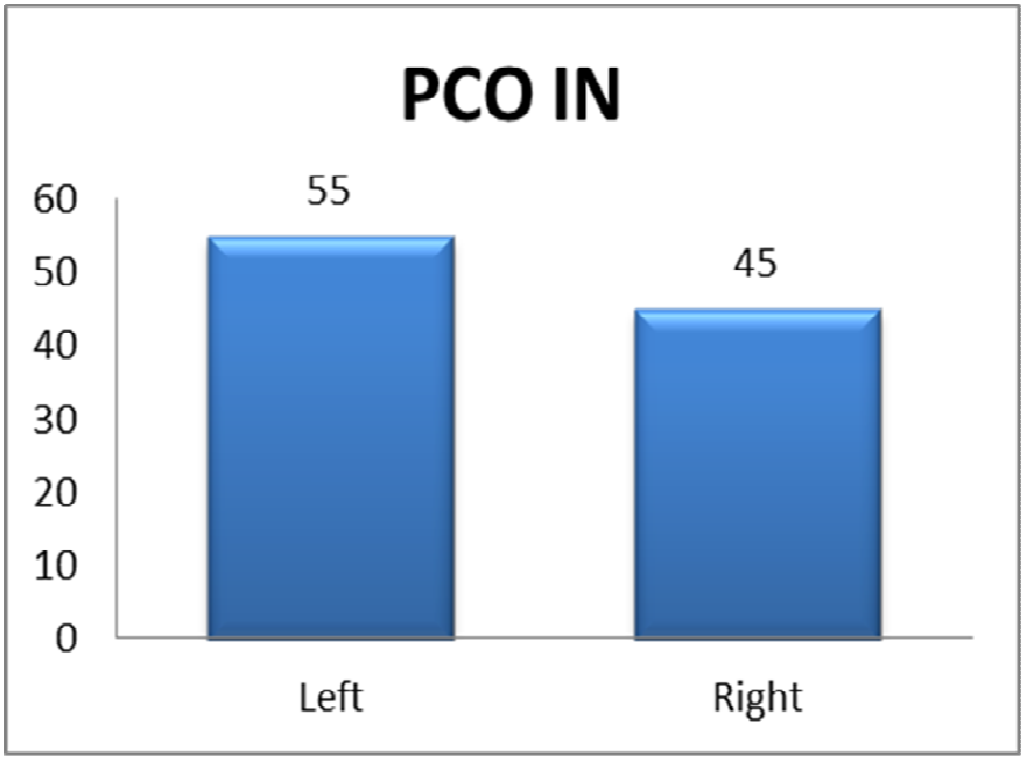
TABLE NO : 2

	N	Minimum	Maximum	Mean	Std. Deviation
AGE 100	**100**	**40**	**83**	**63.19**	**9.530**
Valid N (listwise)	**100**				

TABLE NO 3- POSTERIOR CAPSULAR OPACIFICATION

	Frequency	Percent	Valid Percent	Cumulative Percent
Left	55	55.0	55.0	55.0
Right	45	45.0	45.0	100.0
Total	100	100.0	100.0	100.0

CHART 3



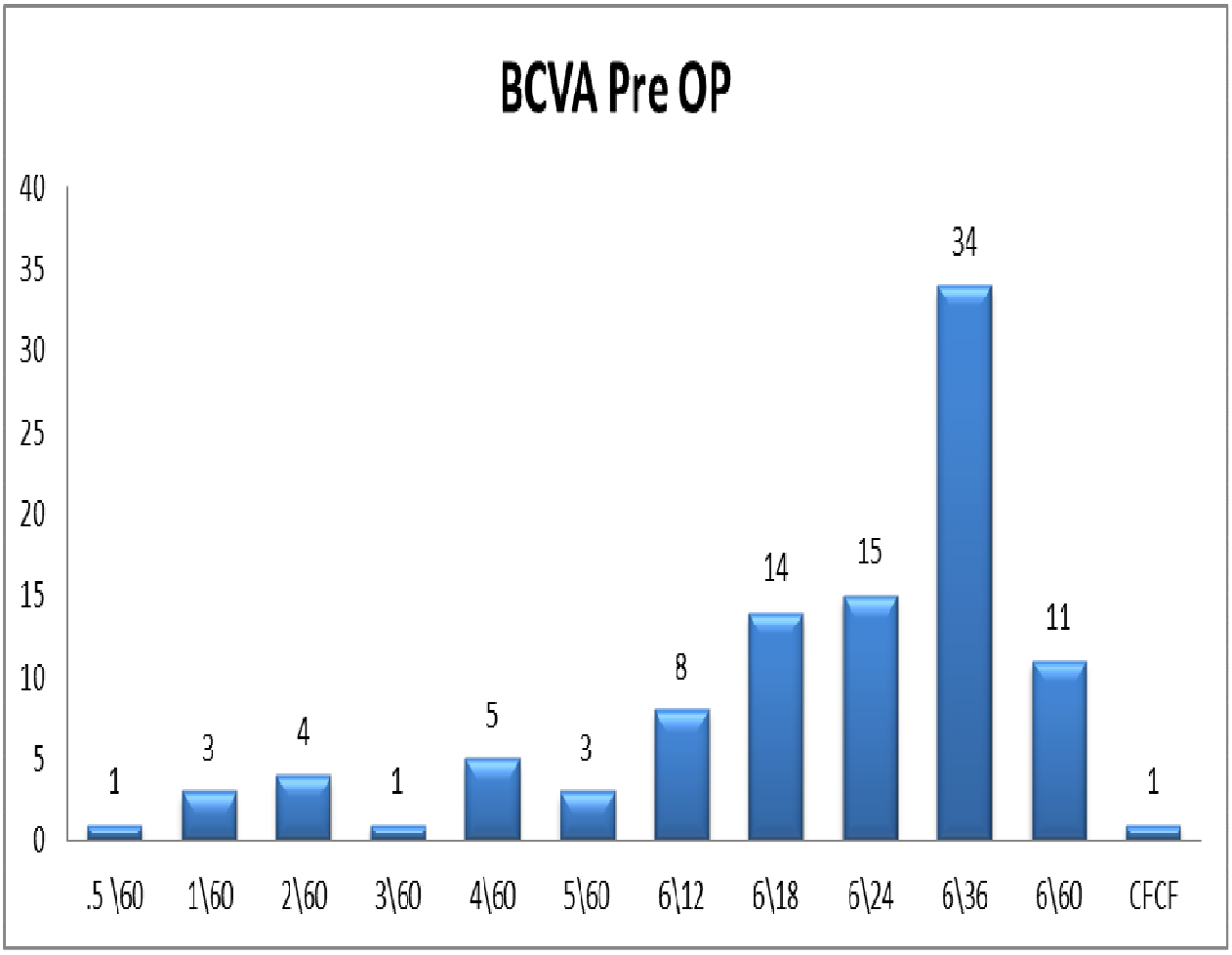
Among the 100 patients selected 55 patients had Posterior Capsular Opacification(PCO) in left eye and 45 patients had PCO in the right eye.

Best Corrected Visual Acuity (BCVA) of the patient was checked with a pin hole before ND YAG laser capsulotomy (pre operatively) it was found that among the 100 patients examined 1 patient had a VA of ½ /60 , 3 patients had BCVA of 1/60, 4 patients had BCVA of 2/60, 1 patient had vision of 3/60 , 5 patients had BCVA of 4/60 , 3 patients had BCVA of 5/60, 8 patients had BCA of 6/12 , 14 patients had BCVA of 6/18 , 15 patients had 6/24 vision , 34 patient s had 6/36 pre operatively, 11 patients had a vision of 6/60, and 1 patient had a very low vision of counting fingers close to face due to a thick PCO.

TABLE NO 4 - BCVA pre operatively before ND YAG Capsulotomy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.5 \60	1	1.0	1.0	1.0
	1\60	3	3.0	3.0	4.0
	2\60	4	4.0	4.0	8.0
	3\60	1	1.0	1.0	9.0
	4\60	5	5.0	5.0	14.0
	5\60	3	3.0	3.0	17.0
	6\12	8	8.0	8.0	25.0
	6\18	14	14.0	14.0	39.0
	6\24	15	15.0	15.0	54.0
	6\36	34	34.0	34.0	88.0
	6\60	11	11.0	11.0	99.0
	CFCF	1	1.0	1.0	100.0
	Total	100	100.0	100.0	

CHART 4- BCVA of 100 patients before ND YAG Capsulotomy



Majority of the patients in the study i.e. 34 out of the hundred patients had a BVCA of 6/36 .

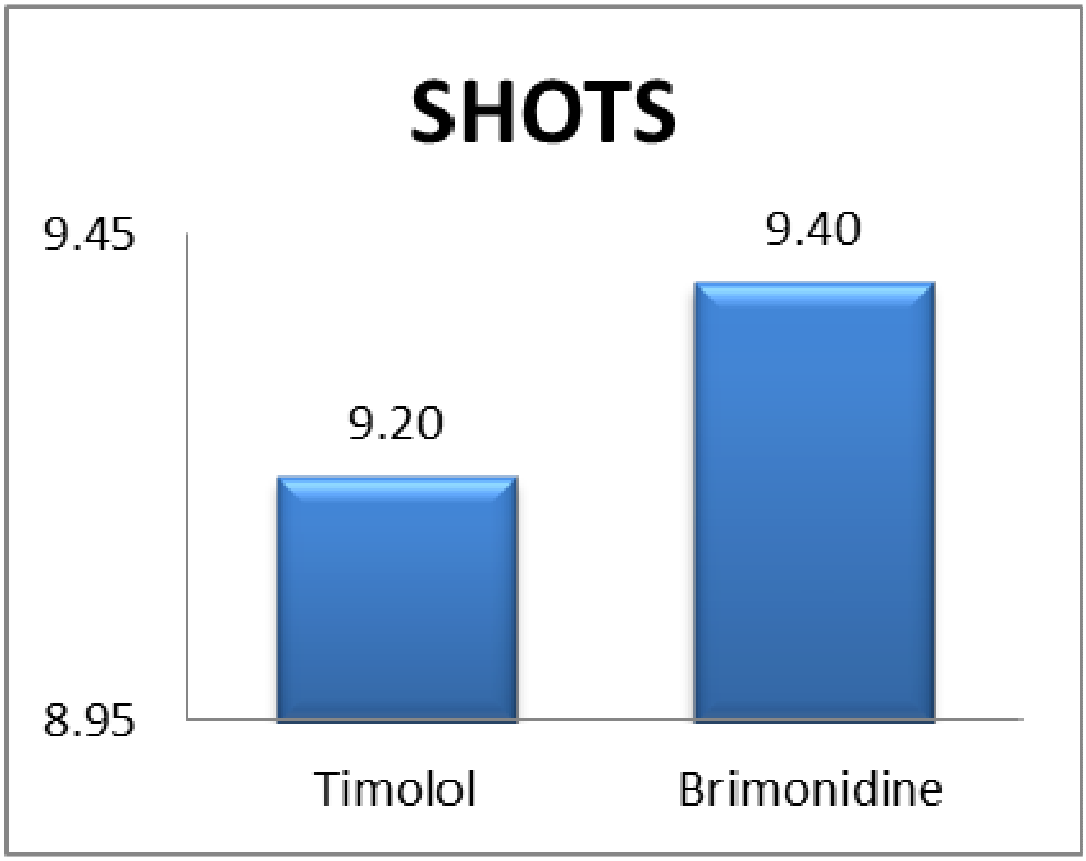
TABLE NO : 5

FUNDUSPRE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	hazy view	100	100.0	100.0	100.0

The fundus examination before the procedure showed the fundus within normal limits with a very hazy view due to the posterior capsular opacification .

CHART 5 - NUMBER OF SHOTS OF ND YAG LASER



The average number of shots of ND YAG laser in the Timolol group was found out to be 9.20 and in the Brimonidine group was found to be 9.40.

TABLE NO: 6

	Timolol	Brimonidine
NCT	16.24	15.76
SHOTS	9.20	9.40
TOTAL ENERGY	35.60	35.34

The mean of the total energy delivered in the timolol group was found out to be 35.60 and in the Brimonidine group was found out to be 35.34 .

CHART 6

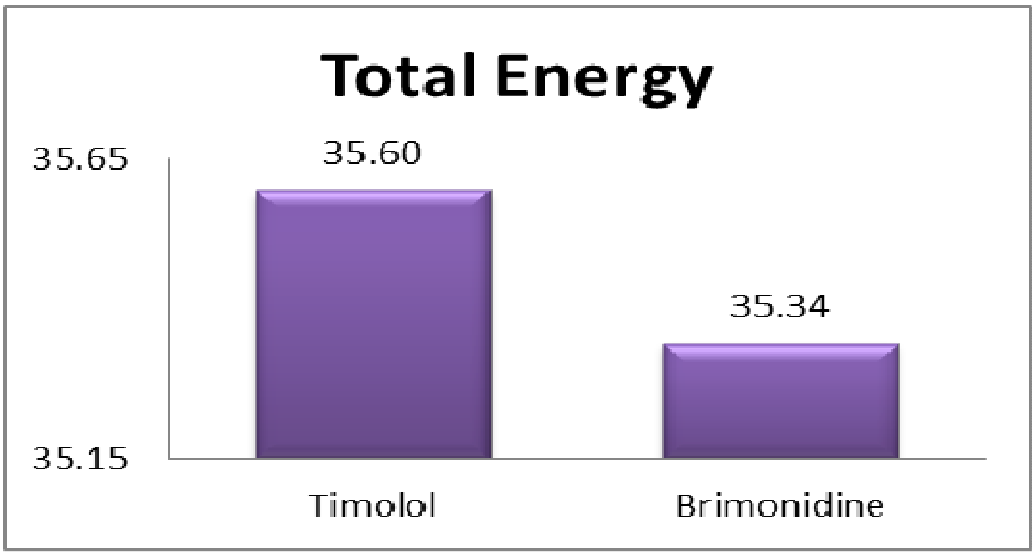


TABLE NO: 7

	Timolol	Brimonidine
TOTAL ENERGY LESS THAN OR = 30	**29**	**34**
TOTAL ENERGY ABOVE 30	**21**	**16**

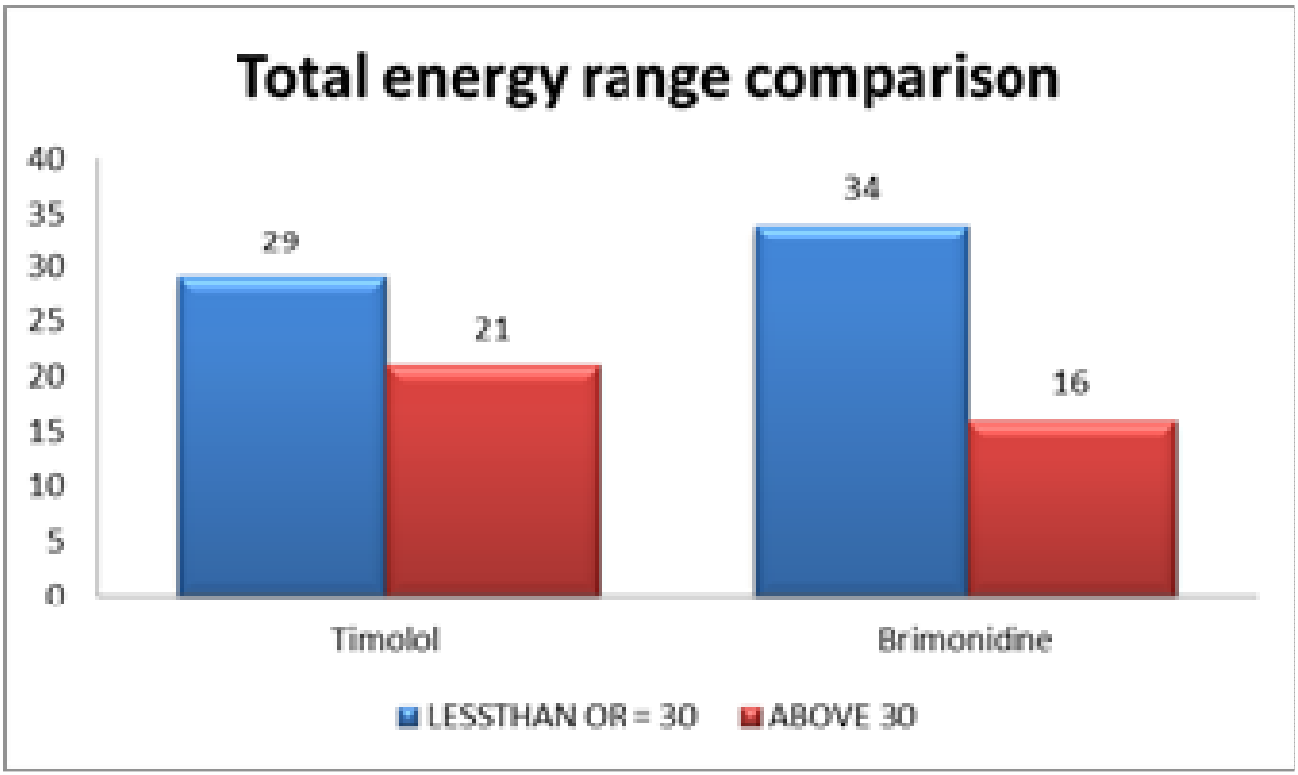
The mean of the total energy in our study was 35.47 mj. Hence **Above 30 mj** was taken as high energy in our study, in the Timolol group in 21 patients more than 30 mj energy was delivered and in Brimonidine group 16 patients had high energy delivered . In timolol group 29 patients had less than 30 mj as the total energy and 34 patients had less than 30 mj delivered.

TABLE NO : 8

Crosstab					
					Total
			Timolol	Brimonidine	
TOTAL ENERGY	LESSTHAN OR = 30	Count	29	34	63
		% within TM	58.0%	68.0%	63.0%
	ABOVE 30	Count	21	16	37
		% within TM	42.0%	32.0%	37.0%
Total		Count	50	50	100
		% within TM	100.0%	100.0%	100.0%

The above cross table compares the difference in total energy delivered between the Timolol and Brimonidine group.

CHART 7



The above graph shows the Total energy range comparision between the Timolol and the Brimonidine group. Above 30 mj was taken as high energy in our study , in the Timolol group in 21 patients more than 30 mj energy was delivered and in Brimonidine group 16 patients had high energy delivered . In timolol group 29 patents had less than 30 mj as the total energy and 34 patients in the Brimonidine group had less than 30 mj delivered.

TABLE NO 9

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.073a	1	.300		
Continuity Correctionb	.686	1	.407		
Likelihood Ratio	1.075	1	.300		
Fisher's Exact Test				.408	.204
Linear-by-Linear Association	1.062	1	.303		
N of Valid Cases	100				

Chi Square Test was applied to study the relationship between the energy used and the rise in IOP . It was found out that **p=.300** indicating that the total energy delivered did not have any relationship with rise in IOP.

TABLE NO 10

Timolol	IOP
IOP 1 HR PRIOR	17.4
IOP 1 HR AFTER	21.6
IOP 4 HR AFTER	18.6
IOP DAY 3	17.6
IOP DAY 7	17.5

In the Timolol group the mean IOP measured with Applanation Tonometry 1 hour prior to ND YAG laser Capsulotomy was 17.4 with a standard deviation of 2.49 , the mean IOP measured 1 hour after the procedure was 21.6 with a standard deviation of 2.84 , mean IOP after 4 hours was 18.6 with a standard deviation of 2.99 , the mean IOP on the 3rd and the 7th day was recorded as 17.6 and 17.5 respectively and with a standard deviation of 2.61 and 2.66 respectively.

CHART 8 - IOP in the Timolol group with Applanation Tonometry

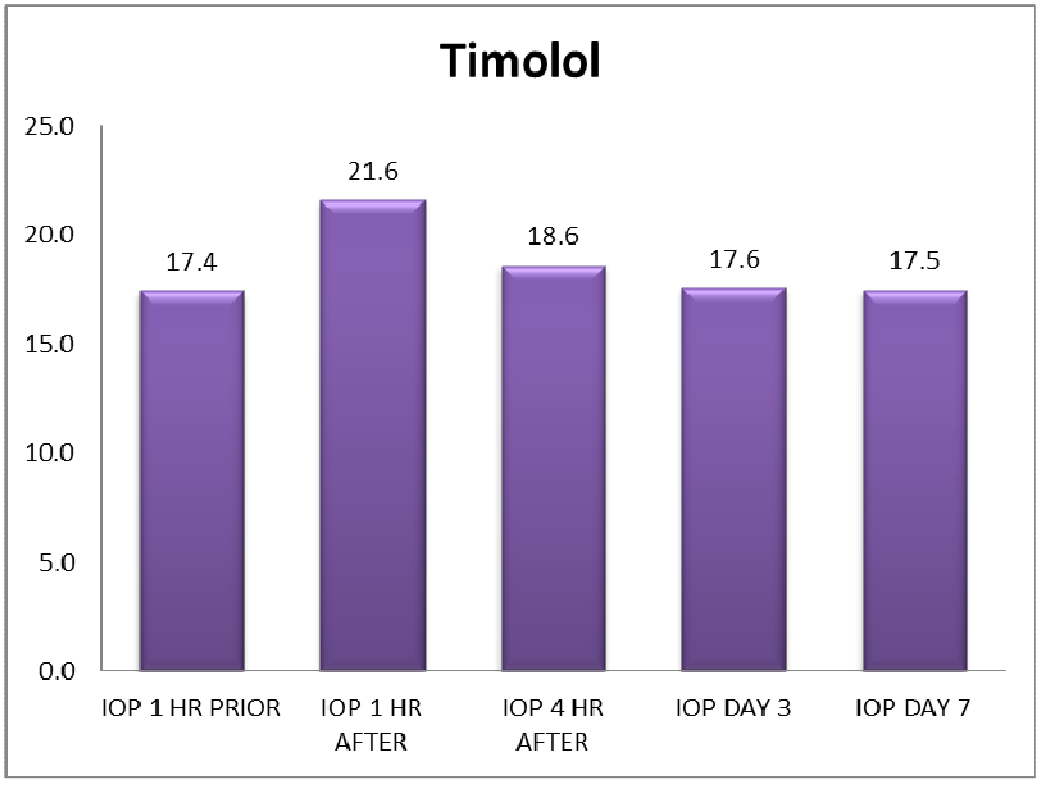


Table NO 11 below shows the descriptive statistics fot Timolol Group

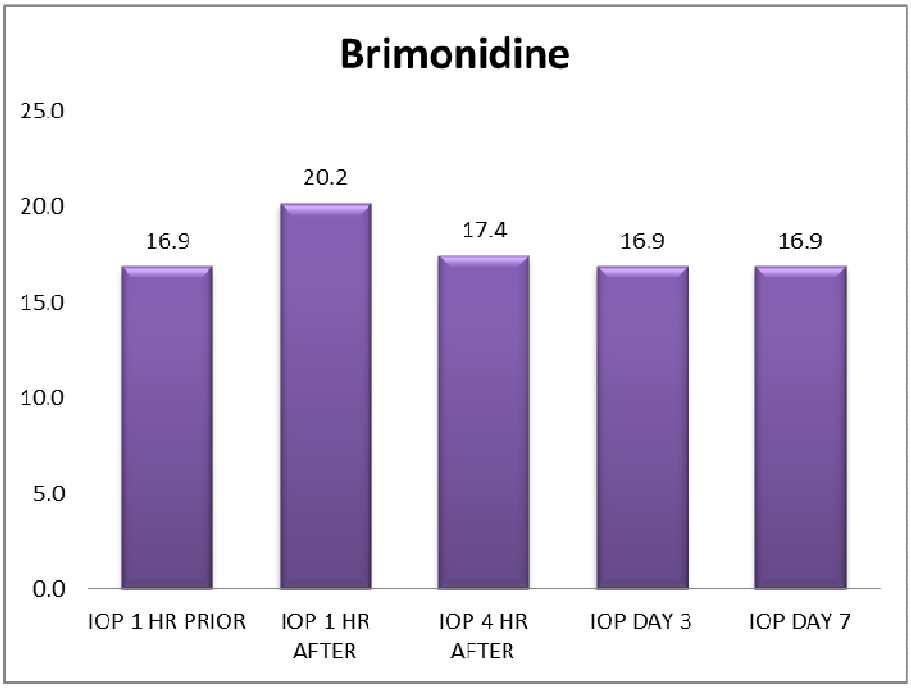
Timolol	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
IOP 1 HR PRIOR	17.444	.352	16.737	18.151
IOP 1 HR AFTER	21.620	.402	20.812	22.428
IOP 4 HR AFTER	18.612	.422	17.763	19.461
IOP DAY 3	17.596	.369	16.854	18.338
IOP DAY 7	17.476	.377	16.719	18.233

DESCRIPTIVE STATISTICS

TABLE NO 12 above shows the descriptive statistics for Brimonidine Group

Brimonidine	**Mean**	**Std. Deviation**	**N**
IOP 1 HR PRIOR	16.876	2.9319	50
IOP 1 HR AFTER	20.198	2.9614	50
IOP 4 HR AFTER	17.438	2.8478	50
IOP DAY 3	16.878	2.9313	50
IOP DAY 7	16.878	2.9313	50

CHART 9



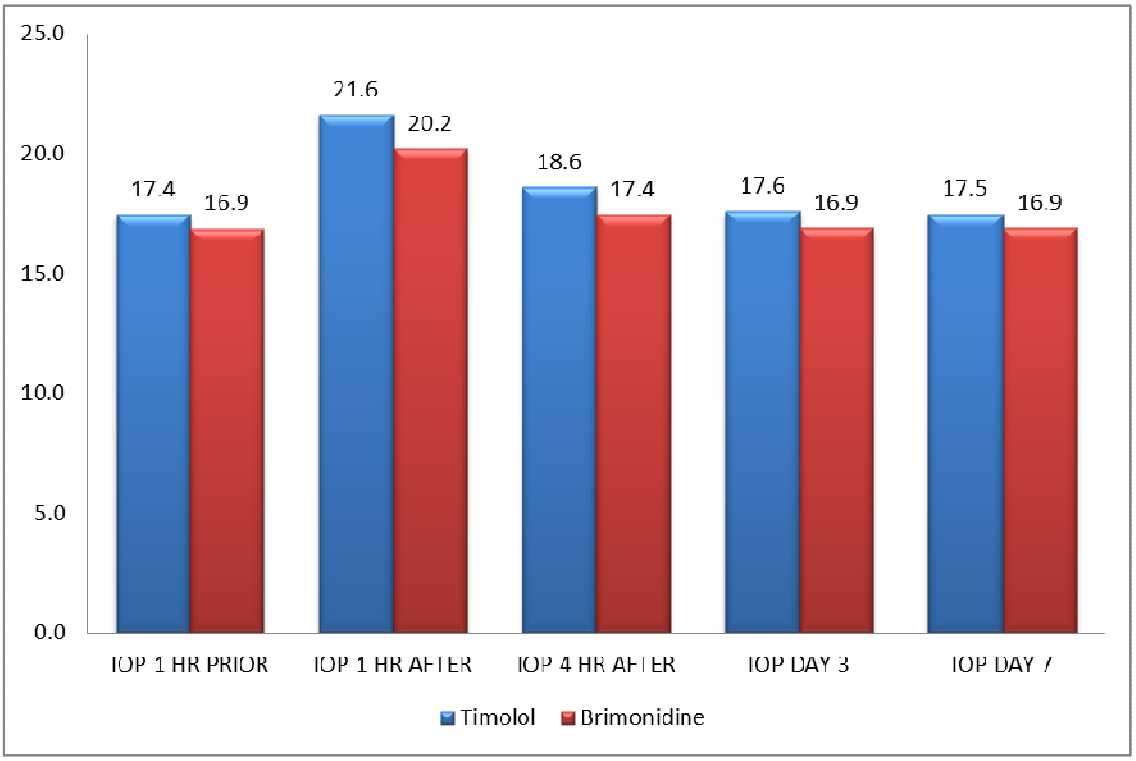
In the Brimoidine group the mean IOP measured with Applanation Tonometry 1 hour prior to ND YAG laser Capsulotomy was 16.9 with a standard deviation of 2.93 , the mean IOP measured 1 hour after the procedure was 20.2 with a standard deviation of 2.96 , mean IOP after 4 hours was 17.4 with a standard deviation of 2.84 , the mean IOP on the 3rd and the 7th day was recorded as 16.8 and with a standard deviation of 2.93 .

TABLE 13 – IOP Brimonidine

IOP	Mean	Std. Error	95% Confidence Interval	
BRIMONIDINE			**Lower Bound**	**Upper Bound**
IOP 1 HR PRIOR	16.876	.415	16.043	17.709
IOP 1 HR AFTER	20.198	.419	19.356	21.040
IOP 4 HR AFTER	17.438	.403	16.629	18.247
IOP DAY 3	16.878	.415	16.045	17.711
IOP DAY 7	16.878	.415	16.045	17.711

Table above shows thedescriptive statistics fot Brimonidine Group In the Brimoidine group the mean IOP measured with Applanation Tonometry 1 hour prior to ND YAG laser Capsulotomy was 16.9 with a standard deviation of 2.93 , the mean IOP measured 1 hour after the procedure was 20.2 with a standard deviation of 2.96 , mean IOP after 4 hours was 17.4 with a standard deviation of 2.84 , the mean IOP on the 3rd and the 7th day was recorded as 16.8 and with a standard deviation of 2.93 .

CHART 10

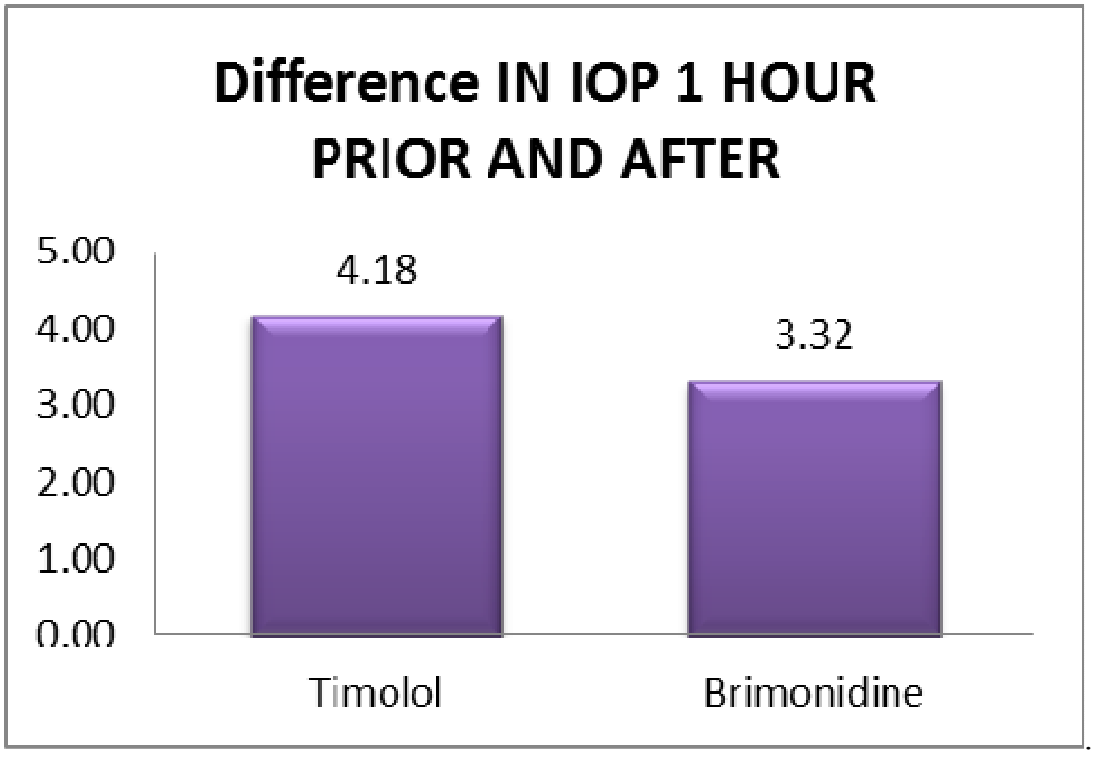


The above bar diagram describes the differences seen between the 2 groups . The mean IOP with Applanation tonometry 1 hour prior to procedure in Timolol group was 17.44 while in the Brimonidine group it was 16.9. The mean IOP with Applanation tonometry 1 hour after the procedure in Timolol group was 21.6 while in the Brimonidine group it was 20.2 . There was a significant rise in mean IOP by 4.2 in the Timolol group while in the Brimonidine group the rise in the mean IOP was 3.3 mm 1 hour after the procedure.

The mean IOP with Applanation tonometry 4 hours after the procedure in Timolol group was 18.6 while in the Brimonidine group it was 17.4 . The rise in mean IOP after 4 hours in the timolol group was 1.2 mm and 0.5 mm in the Brimonidine group.

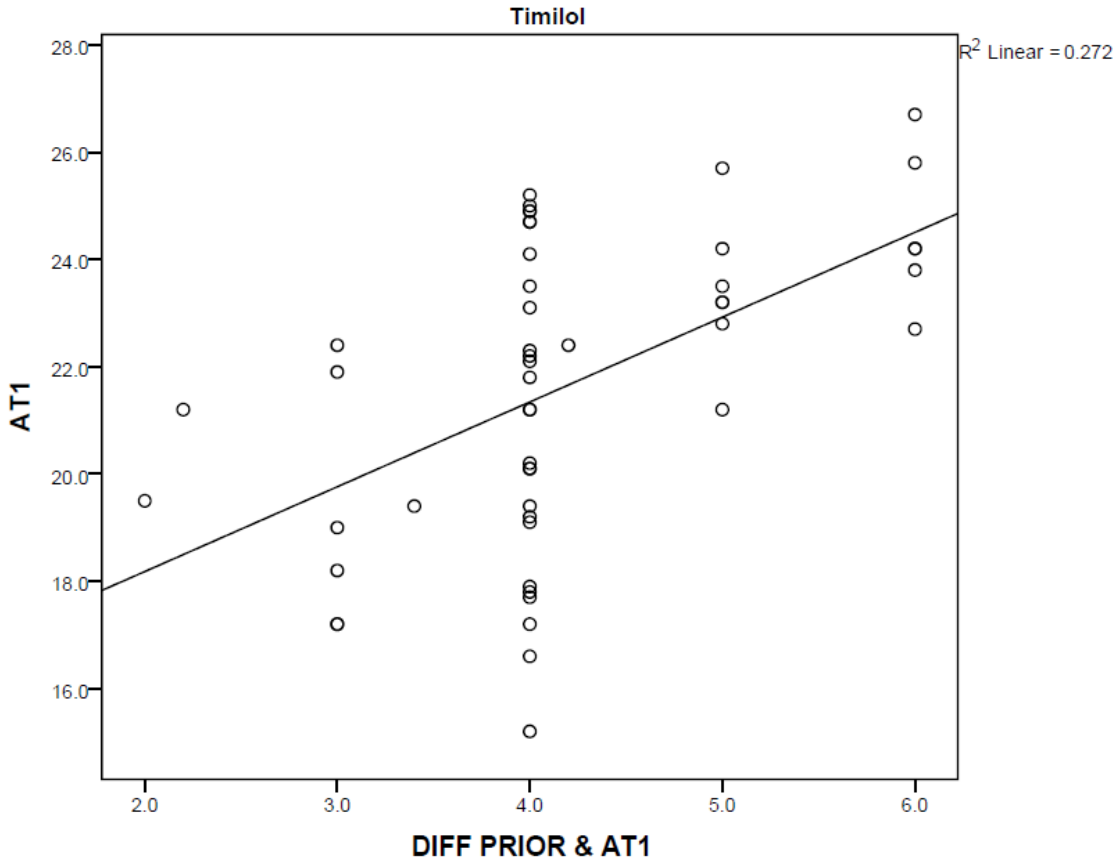
The mean IOP with Applanation tonometry 3rd day after the procedure in Timolol group was 17.6 while in the Brimonidine group it was 16.9 . The mean IOP with Applanation tonometry 7th day after the procedure in Timolol group was 17.5 while in the Brimonidine group it was 16.9 .

CHART 11



The comparison between Timolol and Brimonidine group 1 hr after the procedure shows that there is high statistical difference at P = .016 ≤ .01 level with the mean ± S.D of Timilol (21.62 ± 2.84) and Brimonidine (20.19 ± 2.96). The P value was **p= 0.016** which was statistically very significant. From the above analysis the mean rise in IOP with the Timolol group was found to be 4.18 mm Hg compared to the Brimonidine group for whichit was found to be 3.32 mm Hg. This shows that topical Brimonidine was better than Timolol in the management of rise of IOP following ND Yag Capsulotomy and the rise in Intraocular Pressure was a transient Phenomenon reaching its peak in the first 2 hours and subsiding after the 4^{th} hour and normalising within the 3^{rd} Day.

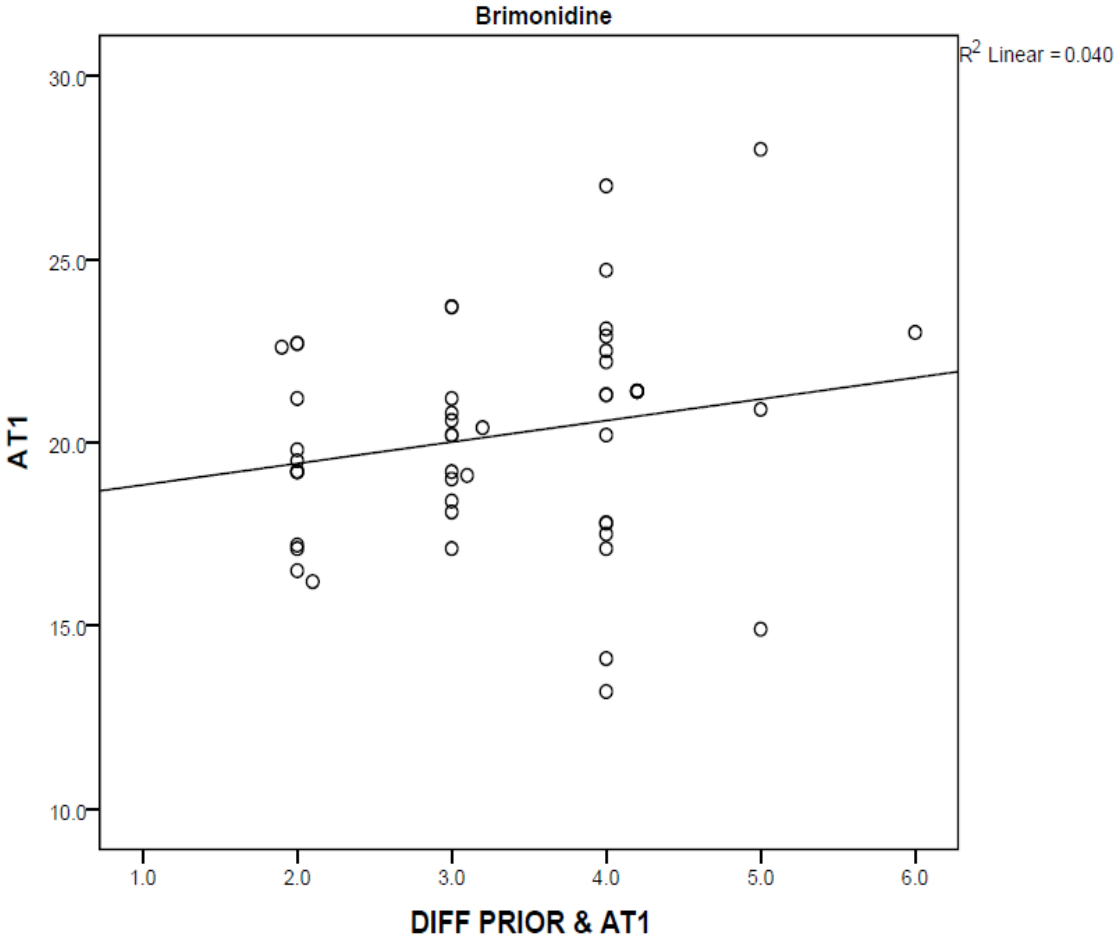
SCATTER DIAGRAM CHART 12



- AT 1- IOP 1 HOUR AFTER , DIFF PRIOR & AT1- DIFFERENCE IN IOP 1 HOUR PRIOR AND AFTER

The above graph represents the relationship between mean IOP with Applanation Tonometry 1 hour after the procedure and difference between the mean IOP 1 hour prior and 1 hour after applanation tonometry in the Timolol group. The graph indicates a significant rise in the IOP after the procedure (ND YAG) in the Timolol group . The relationship is linear and significant.

SCATTER DIAGRAM CHART 13



- AT 1- IOP 1 HOUR AFTER , DIFF PRIOR & AT1- DIFFERENCE IN IOP 1 HOUR PRIOR AND AFTER

The above graph represents the relationship between mean IOP with Applanation Tonometry 1 hour after the procedure and difference between the mean IOP 1 hour prior and 1 hour after applanation tonometry in the Brimonidine group. The graph indicates a significant rise in the IOP after the procedure (ND YAG) in the Brimonidine group . The relationship is linear and less significant than compared to Timolol .

TABLE NO 14 - CHI SQUARE TEST TIMOLOL

TIMOLOL GROUP	DIFF IOP 1 HR PRIOR AND AFTER		
DIFF IOP 1 HR PRIOR AND AFTER	Pearson Correlation	1	.522**
	Sig. (2-tailed)		.0001
	N	50	50
IOP I HOUR AFTER	Pearson Correlation	.522**	1
	Sig. (2-tailed)	.0001	
	N	50	50

Chi square test for the Timolol group the IOP measured 1 hour prior and 1 hour after the procedure with applanation tonometry showed a significant rise in IOP after the procedure with a P=0.0001.

TABLE NO 15 -CHI SQUARE TEST Brimonidine

	DIFF IOP 1 HR PRIOR AND AFTER	Brimonidine	
DIFF IOP 1 HR PRIOR AND AFTER	Pearson Correlation	1	.199
	Sig. (2-tailed)		.166
	N	50	50
IOP I HOUR AFTER	Pearson Correlation	.199	1
	Sig. (2-tailed)	.166	
	N	50	50

Chi square test for the Brimonidine group the IOP measured 1 hour prior and 1 hour after the procedure with applanation tonometry showed a rise in IOP after the procedure with a P=0.166 . The study showed that the rise in IOP in Brimonidine group was not significant.

TABLE NO 16 – DESCRIPTIVE STATISTICS TIMOLOL GROUP

Timolol	N	Minimum	Maximum	Mean	Std. Deviation
AGE	50	42	83	64.90	9.117
Timilol	50	1	1	1.00	0.000
NCT	50	10	20	16.24	2.520
SHOTS	50	4	18	9.20	2.718
ENERGY	50	2	9	3.88	2.344
TE	50	11	90	35.62	20.979
IOP 1 HR PRIOR	50	11	21	17.42	2.532
DIFF PRIOR1	50	2	6	4.16	.955
IOP 1 HR AFTER	50	15	27	21.60	2.907
IOP 4 HR AFTER	50	10	25	18.58	3.058
IOP DAY 3	50	11	22	17.56	2.659
IOP DAY 7	50	9	21	17.44	2.712

The above table represents the Descriptive Statistics for the Timolol group indicating the maximum , minimum, the mean and standard deviation for all the variables being tested.

TABLE NO 17- DESCRIPTIVE STATISTICS BRIMONIDINE GROUP

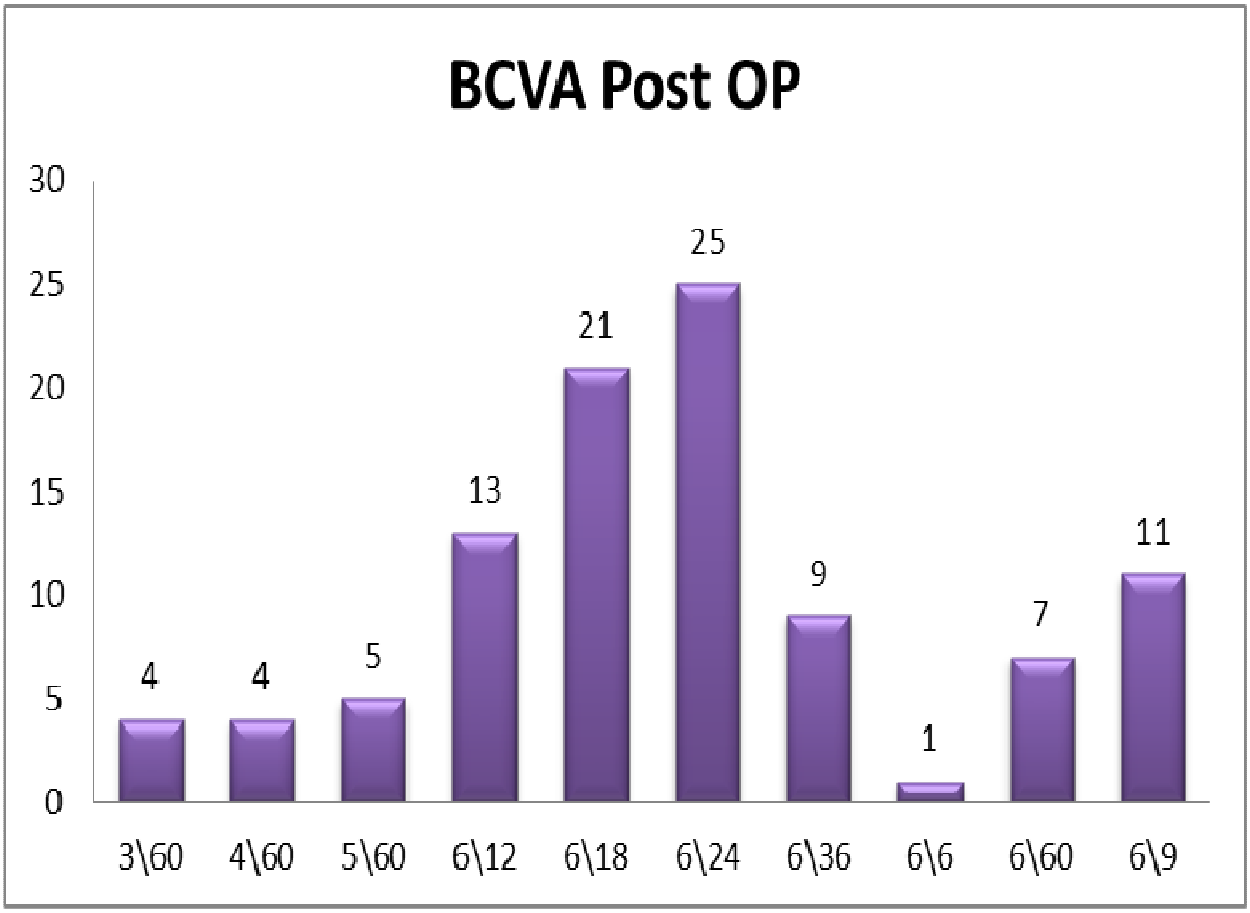
Brimonidine	N	Minimum	Maximum	Mean	Std. Deviation
AGE	50	40	82	61.48	9.717
TM	50	2	2	2.00	0.000
NCT	50	9	20	15.76	2.782
SHOTS	50	2	15	9.40	3.064
ENERGY	50	2	7	3.68	2.334
TE	50	4	91	35.38	22.031
IOP 1 HR PRIOR	50	9	23	16.84	2.992
DIFF PRIOR1	50	2	6	3.30	.995
IOP 1 HR AFTER	50	13	28	20.14	3.017
IOP 4 HR AFTER	50	10	23	17.40	2.914
IOP DAY 3	50	9	23	16.84	2.992
IOP DAY 7	50	9	23	16.84	2.992

The above table represents the Descriptive Statistics for the Brimonidine group indicating the maximum , minimum, the mean and standard deviation for all the variables being tested.

TABLE NO 18		N	Mean	Std. Deviation	Std. Error Mean
NCT	Timilol	50	16.240	2.5198	.3564
	Brimonidine	50	15.760	2.7816	.3934
SHOTS	Timilol	50	9.200	2.7180	.3844
	Brimonidine	50	9.400	3.0639	.4333
ENERGY	Timilol	50	4.024	2.2408	.3169
	Brimonidine	50	3.846	2.2283	.3151
TE	Timilol	50	35.598	21.0001	2.9699
	Brimonidine	50	35.342	22.0680	3.1209
IOP 1 HR PRIOR	Timilol	50	17.444	2.4860	.3516
	Brimonidine	50	16.876	2.9319	.4146
DIFF IOP	Timilol	50	4.176	.9378	.1326
	Brimonidine	50	3.322	1.0066	.1424
IOP 1 HR AFTER	Timilol	50	21.620	2.8427	.4020
	Brimonidine	50	20.198	2.9614	.4188
IOP 4 HR AFTER	Timilol	50	18.612	2.9872	.4224
	Brimonidine	50	17.438	2.8478	.4027
IOP DAY 3	Timilol	50	17.596	2.6097	.3691
	Brimonidine	50	16.878	2.9313	.4146
IOP DAY 7	Timilol	50	17.476	2.6625	.3765
	Brimonidine	50	16.878	2.9313	.4146

The table in the previous page represents the group statistics for the Timolol and Brimonidine group showing the Mean, Standard deviation, and Standard Error of Mean for the variables compared in the study. The comparison between Timilol and Brimonidine group with applanation 1 hr after the procedure shows that there is high statistical difference at P = .016 ≤ .01 level with the mean ± S.D of Timilol (21.62 ± 2.84) and Brimonidine(20.19 ± 2.96).

CHART 14



The BCVA in the patients after the procedure 4 patients had a Visual acuity of 3/60 , 4 patients had a patients had a Visual acuity of 4/60 , 5 patients had a patients had a Visual acuity of 5/60 , 13 patients had a patients had a Visual acuity of 6/12, 21 patients had a patients had a Visual acuity of 6/18, 25 patients had a patients had a Visual acuity of 6/24 , 9 patients had a patients had a Visual acuity of 6/36, 1 patient had a vision of 6/6 , 11 patients had a vision of 6/9.

TABLE NO 19 - BCVA POST PROCEDURE

Frequency	Percent	Valid Percent	Cumulative Percent		
Valid	3\60	4	4.0	4.0	4.0
	4\60	4	4.0	4.0	8.0
	5\60	5	5.0	5.0	13.0
	6\12	13	13.0	13.0	26.0
	6\18	21	21.0	21.0	47.0
	6\24	25	25.0	25.0	72.0
	6\36	9	9.0	9.0	81.0
	6\6	1	1.0	1.0	82.0
	6\60	7	7.0	7.0	89.0
	6\9	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

CHART 15

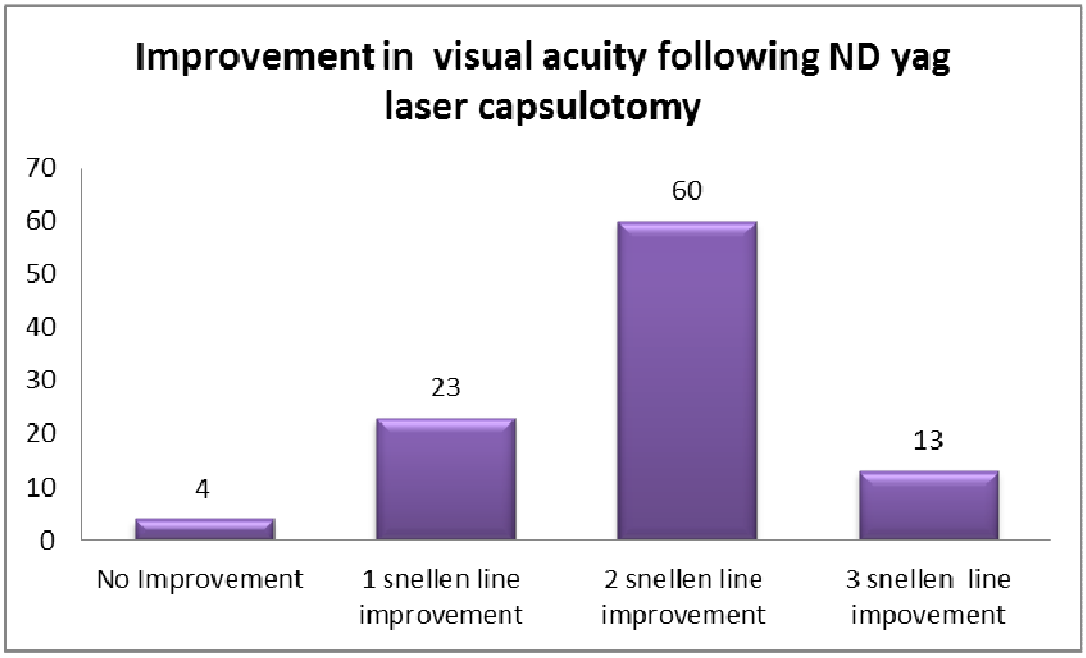
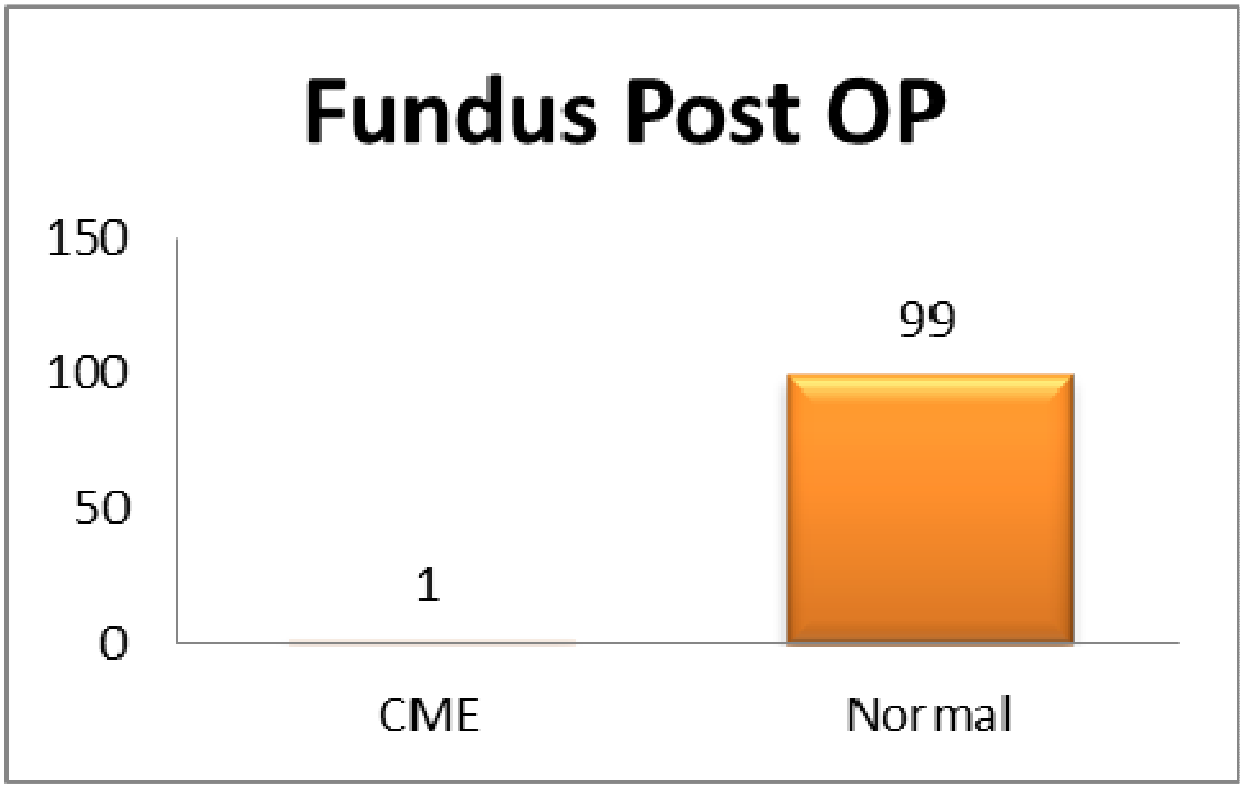


TABLE 2O – SNELLEN CHART IMPROVEMENT

No Improvement	4
1 snellen line improvement	23
2 snellen line improvement	60
3 snellen line impovement	13

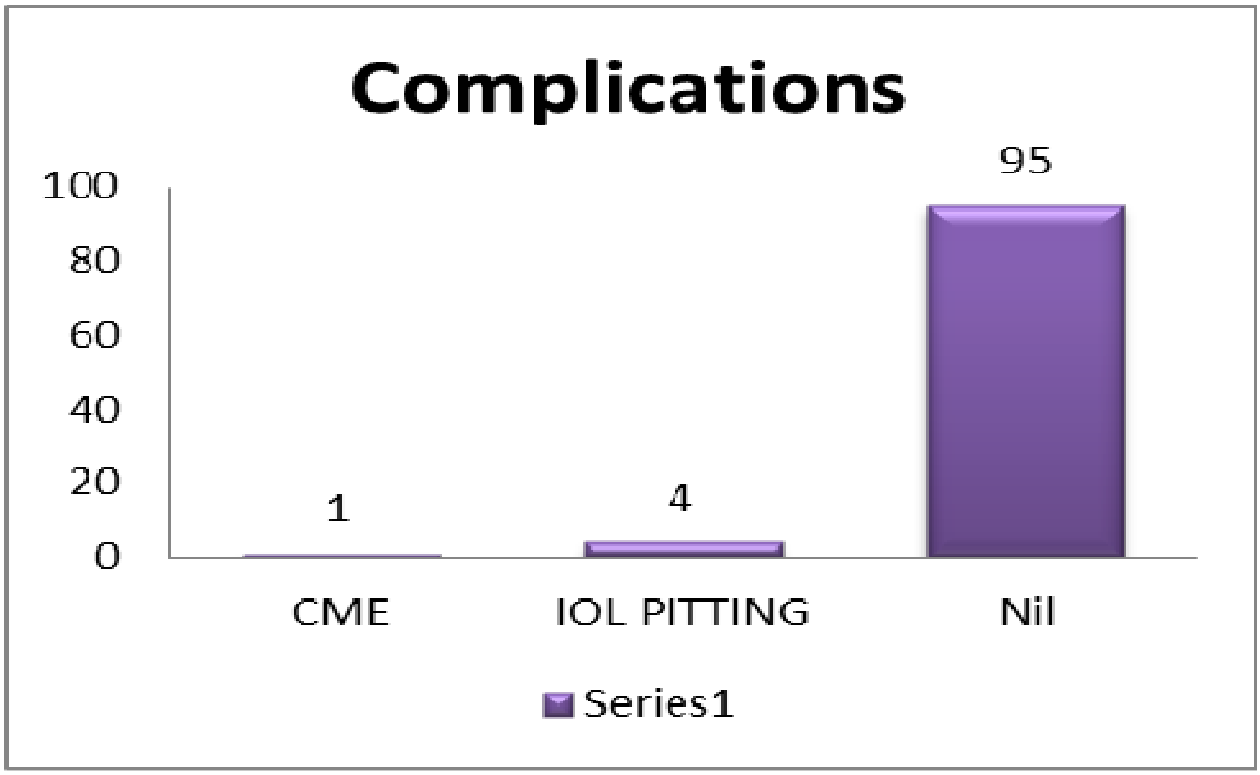
Following ND YAG capsulotomy 4 patients had no improvement in visual acuity ,23 patients had 1 line improvement in snellen chart , 60 patients had 2 line improvement in snellen chart, 13 patients had 3 line improvement in snellen chart. Most of the patients i.e. 60 in our study had a 2 line improvement in the snellen's chart.

CHART 16



The fundus examination of the 100 patients followed for a week after the procedure showed a normal fundus examination in 99 patients and 1 patient had cystoid macular edema (CME).

CHART 17



The Complications seen after ND YAG laser Capsulotomy 95 patients did not have any complications after the procedure , 4 patients had IOL pitting and 1 patient had Cystoid Macular Edema.

DISCUSSION

Posterior Capsular Opcacification or after cataract is an frequent complication and an important cause of diminision of vision in a patient operated for Cataract Surgery. The incidence of PCO varies from 7 – 31 % 2 years post operatively.

The main modality of management of PCO is ND YAG Capsulotomy which consists of Neodymium Yttrium Aluminum Garnet crystal that produces parallel beam of Infra Red rays with a wavelength of 1064 nm which acts by photodisruption . The high peak power pulse directed into the eye results in photo-disruption accomplished by the acoustic wave generated by the plasma. The size of the plasma increases with increase in energy causing a larger and stronger acoustic wave .

Transient rise in IOP is a frequent and transient complication of ND YAG Capsulotomy which occurs as a consequence of obstruction of the outflow pathway by debris and macromolecules scattered by the laser treatment..

Both Topical Brimonidine (an alpha adrenergic agent) and Timolol (beta locker) can be effective in management of rise in IOP following **ND YAG** Capsulotomy.This study compared the efficacy of Timolol and Brimonidine in managing the rise of IOP.

The study was an Open-label, Randomized hospital based study conducted in the Ophthalmology Department of Coimbatore Medical College Hospital. 100 Patients in the age group between 40 to 70 years were selected study were matched in terms of age and sex. Among the 100 patients selected randomly for the study 45 were males and remaining 55 were females

50 of these patients were given 1 drop of 0.5% Timolol eye drops 1 hour before the procedure and 1 drop after the procedure and asked to apply 0.5% Timolol eye drops twice a day for the next 7 days . 50 of these patients were given 1 drop of 0.2% Brimonidine eye drops 1 hour before the procedure and I drop after the procedure and asked to apply 0.2% Brimonidine eye drops twice a day for the next 7 days .

Among the 100 patients selected for the study 22 of the were between the age group of 40-55 years , 43 patients were in the age group of 56- 65 years , 26 patients were in the age group of 66 to 75 years and 9 of the patients were above 75 years.

The minimum age of the patient selected for the study was 40 years and maximum age was 83 years the mean for the 100 patients was calculated as 63.19 and the standard deviation from the mean was noted as 9.530

55 patients had Posterior Capsular Opacification (PCO) in left eye and 45 patients had PCO in the right eye.

Hollick EJ et al[13] showed that occurance of PCO(posterior capsule opacification) is shown to vary with different studies. Rates of posterior capsule opacification have been reported as 10–56% at 3 years with differing lens materials.

Auffarth GU et al [14] did several studies and reported that the incidence of posterior capsule opacification is lower if a meticulous cortical clean-up is performed.

Werner L et al [15] showed that square edge lens designs hydrophobic acrylic lenses have been found to decrease posterior capsule opacification by decreasing the migration of lens epithelial cells.

Chan RY et al [16] proved that mitotic inhibitors when instilled into the anterior chamber after extracapsular cataract extraction have shown to reduce capsular opacification significantly.

Hollick EJ,et al [13] conducted a large post-mortem review and found the prevalence of Nd: YAG capsulotomy was 12%-21 % for various silicone IOLs, 0.9% for acrylic IOLs, , and 27%- 33% for polymethylmethacrylate IOLs.

The incidence of opacification at 3 years has been reported at 40% for silicone, 56% for polymethylmethacrylate, and 10% for acrylic material, although the Nd:YAG rate is lower.[18]

Above 30 mj was taken as high energy in our study, in the Timolol group in 21 patients more than 30 mj energy was delivered and in Brimonidine group 16 patients had high energy delivered. In Timolol group 29 patents had less than 30 mj as the total energy and 34 patients had less than 30 mj delivered.

The total energy and number of laser pulses delivered do not appear to be contributing factors in the rise of IOP according to the study done by Steinert RF et al [23] .

Chi Square Test was applied to study the relationship between the energy used and the rise in IOP. It was found out that **p=.300** indicating that the total energy delivered did not have any relationship with rise in IOP..

The risk of CME and retinal detachment may be greater when Nd:YAG capsulotomy is performed within 6 months of cataract surgery.[21]

The safest approach is to focus the laser beam slightly behind the posterior surface of the capsule for the initial application and then move the subsequent applications anteriorly until the desired puncture is achieved. [20]

Altamirano D, et al found out that Nd:YAG capsulotomy leads to reduction in the aqueous outflow by the obstruction of the trabecular meshwork by inflammatory cells, capsular particles, ,and protein and by producing prostaglandin-mediated effects.[31]

Richter CU et al studied that capsulotomy is associated with increased IOP in normal eyes years after the procedure has been completed.[28]

Lin JC, et al conducted a study in glaucoma patients and started the patients on aggressive glaucoma medication and concluded that it was unclear whether progression of glaucoma was related directly to Nd Yag capsulotomy or whether it was independent progression of glaucoma unrelated to YAG Capsulotomy.[37]

Ge J, et al found out that the rise in IOP in long term basis was related significantly to the IOP increase which occurred 1 hour after ND YAG capsulotomy (P =. 001). Patients having glaucoma required long-term additional glaucoma medication than non glaucoma patients after the capsulotomy (P =.002).[36]

Demer JL et al confirmed that the rise in IOP which is typically transient may ocasionally persist and rise in IOP occurs in the first 2 hrs after the procedure .[30]

The average number of shots of ND YAG laser in the Timolol group was found out to be 9.20 and in the Brimonidine group was found to be 9.40.

The mean of the total energy delivered in the timolol group was found out to be 35.60 and in the Brimonidine group was found out to be 35.34 .

The total energy and number of laser pulses delivered do not appear to be contributing factors in the rise of IOP according to the study done by Steinert RF et al [23] .

In the Timolol group the mean IOP measured with Applanation Tonometry 1 hour prior to ND YAG laser Capsulotomy was 17.4 with a standard deviation of 2.49 , the mean IOP measured 1 hour after the procedure was 21.6 with a standard deviation of 2.84 , mean IOP after 4 hours was 18.6 with a standard deviation of 2.99 , the mean IOP on the 3rd and the 7th day was recorded as 17.6 and 17.5 respectively and with a standard deviation of 2.61 and 2.66 respectively.

In the Brimoidine group the mean IOP measured with Applanation Tonometry 1 hour prior to ND YAG laser Capsulotomy was 16.9 with a standard deviation of 2.93 , the mean IOP measured 1 hour after the procedure was 20.2 with a standard deviation of 2.96 , mean IOP after 4 hours was 17.4 with a standard deviation of 2.84 , the mean IOP on the 3rd and the 7th day was recorded as 16.8 and with a standard deviation of 2.93 .

The comparison between Timolol and Brimonidine I hour after procedure shows that there is **high statistical difference at P = .016 ≤ .01** level with the mean ± S.D of Timolol (21.62 ± 2.84) and Brimonidine (20.19 ± 2.96). The P value was **p= 0.016** which was statistically very significant. From the above analysis the mean rise in IOP with the Timolol group was found to be 4.18 mm Hg compared to the Brimonidine group for which it was found to be 3.32 mm Hg. This shows that topical Brimonidine was better than Timolol in the management of rise of IOP following ND Yag Capsulotomy and the rise in Intraocular Pressure was a Transient Phenomenon reaching its peak in the first 2 hours and subsiding after the 4th hour and normalising within the 3rd Day.

Chi square test for the Timolol group the IOP measured 1 hour prior and 1 hour after the procedure with applanation tonometry showed a significant rise in IOP after the procedure with a P=0.0001.

Chi square test for the Brimonidine group the IOP measured 1 hour prior and 1 hour after the procedure with applanation tonometry showed a rise in IOP after the procedure with a P=0.166 . The study showed that the rise in IOP in Brimonidine group was not significant.

Following ND YAG capsulotomy 4 patients had no improvement in visual acuity ,23 patients had 1 snellen chart improvement , 60 patients had 2 snellen chart improvement, 13 patients had 3 snellen chart improvement.

The Complications seen after ND YAG laser Capsulotomy 95 patients did not have any complications after the procedure , 4 patients had IOL pitting and 1 patient had Cystoid Macular Edema.

The risk of CME and retinal detachment may be greater when Nd:YAG capsulotomy is performed within 6 months of cataract surgery.[21]

Gartaganis SP et al studied the prevention of IOP elevaton following ND YAG capsulotomy with the usage of topical brimonidine eye drops .[49]

Simsek S et al concluded that topical 0.25% apraclonidine eye drops is effective in preventing the early elevation of IOP (intraocular pressure) after Nd:YAG laser posterior capsulotomy and may be used as an alternative to topical 0.50% timolol maleate and topical 1% apraclonidine.[50]

Richter CU et al found that fewer patients treated with 0.5% timolol eye drops developed an IOP elevation of 5 mm Hg or more than the control patients.[46]

Cai JP, Cheng JW et al studied the prophylactic use of topical 0.5 % timolol maleate eyedrops to prevent IOP elevation after Nd-YAG laser posterior capsulotomy .[44]

Chen TC et al found that in patients subjected to Nd: YAG capsulotomy close observation was required to treat postoperative intra ocular pressure elevation. Topical brimonidine and apraclonidine are very effective in preventing acute IOP spikes following Nd: YAG laser treatment.[32]

The rise in IOP 1 hour after the procedure was statistically significant in the Topical Timolol group . The rise in IOP was transient and continued to be high 4 hours after the procedure. The IOP normalised on the 3rd and 7th day of treatment . It was found out that the patients treated in the Timolol group had a mean rise in IOP of 4.18 mm Hg 1 hour after the procedure while the patients in th Brimonidine group had a mean rise of 3.32mm Hg 1 hour after the procedure. The chi- square test showed the p= 0.016 which was statistically very significant . Hence our study concludes that Brimonidine controls the transient rise in IOP better than Timolol following ND YAG Capsulotony.

SUMMARY

"Comparing efficacy of Topical anti glaucoma Medication in monitoring rise in IOP following Nd-YAG Capsulotomy." an Open-label, Randomized hospital based study conducted in the Ophthalmology Department of Coimbatore Medical College Hospital from August 2013 – July 2014.

-100 Patients in the age group between 40 to 70 years having diminision of vision due to posterior capsular opacification visiting the Out Patient were selected .

-Study subjects who consent to be a part of the study were matched in terms of age and sex

-In the study 45 were males and remaining 55 were females.

- In the study the majority of the patients were in the age group of 56- 65 years i.e. 43 patients.

-The minimum age of the patient selected for the study was 40 years and maximum age was 83 years the mean for the 100 patients was calculated as 63.19.

-50 patients received 1 drop of 0.5 % Timolol eye drops 1 hour before and 1 hour after the procedure and for 7 days after the procedure.

-50 patients received 1 drop of 0.2% Brimonidine eye drops 1 hour before and 1 hour after the procedure and for 7 days after the procedure .

-The average number of shots of ND YAG laser in the Timolol group was found out to be 9.20 and in the Brimonidine group was found to be 9.40.

-The mean of the total energy delivered in the timolol group was found out to be 35.60mj and in the Brimonidine group was found out to be 35.34mj .

The total energy and number of laser pulses delivered do not appear to be contributing factors in the rise of IOP according to the study done by Steinert RF et al [23] .

-In the Timolol group the mean IOP measured with Applanation Tonometry 1 hour prior to ND YAG laser Capsulotomy was 17.4 with a standard deviation of 2.49, the mean IOP measured 1 hour after the procedure was 21.6 with a standard deviation of 2.84, mean IOP after 4 hours was 18.6 with a standard deviation of 2.99, the mean IOP on the 3rd and the 7th day was recorded as 17.6 and 17.5 respectively and with a standard deviation of 2.61 and 2.66 respectively.

-In the Brimoidine group the mean IOP measured with Applanation Tonometry 1 hour prior to ND YAG laser Capsulotomy was 16.9 with a standard deviation of 2.93, the mean IOP measured 1 hour after the procedure was 20.2 with a standard deviation of 2.96, mean IOP after 4 hours was 17.4 with a standard deviation of 2.84, the mean IOP on the 3rd and the 7th day was recorded as 16.8 and with a standard deviation of 2.93 .

The initial transient rise in IOP following ND YAG Capsulotomy in patients of the brimonidine group was significantly less than the Timolol group.

Normalisation of IOP was same in both the Timolol Group and Brimonidine group .

-The comparison between Timolol and Brimonidine group 1 hr after shows that there is high statistical difference at **P = .016 ≤ .01** level with the mean ± S.D of Timolol (21.62 ± 2.84) and Brimonidine (20.19 ± 2.96). The P value was **p= 0.016** which was statistically very significant. From the above analysis the mean rise in IOP with the Timolol group was found to be 4.18 mm Hg compared to the Brimonidine group for which it was found to be 3.32 mm Hg. This shows that topical Brimonidine was better than Timolol in the management of rise of IOP following ND Yag Capsulotomy and the rise in

Intraocular Pressure was a transient Phenomenon reaching its peak in the first 2 hours and subsiding after the 4th hour and normalising within the 3rd Day.

The Total number of shots and the total energy used did not have any correlationship with in rise in IOP.

-Chi square test for the Timolol group the IOP measured 1 hour prior and 1 hour after the procedure with applanation tonometry showed a significant rise in IOP after the procedure with a **P=0.0001.**

-Chi square test for the Brimonidine group the IOP measured 1 hour prior and 1 hour after the procedure with applanation tonometry showed a rise in IOP after the procedure with a **P=0.166** . The study showed that the rise in IOP in Brimonidine group was not significant.

Even though after 4 hours of procedure IOP in both groups normalised the initial difference in transtient rise of IOP in both the groups was statistically significant. (IOP rise was higher with Timolol group than Brimonidine group).

- Following ND YAG capsulotomy 4 patients had no improvement in visual acuity ,23 patients had 1 line improvement in snellen chart , 60 patients had 2 line improvement in snellen chart, 13 patients had 3 line improvement in snellen chart.

Most of the patients i.e. 60 in our study had a 2 line improvement in the snellen's chart.

-The Complications seen after ND YAG laser Capsulotomy 95 patients did not have any complications after the procedure , 4 patients had IOL pitting and 1 patient had Cystoid Macular Edema.

The patients undergoing ND YAG laser capsulotomy for Posterior Capsular Opacification require a close monitoring in IOP as the rise in transient. Simple premedication with topical Timolol and Brimonidine 1 hour prior and 1 hour after the procedure is an easy and effective way in managing this complication.

The rise in IOP 1 hour after the procedure was significant in both the Topical Timolol and Brimonidine group . The rise in IOP was transient and continued to be high 4 hours after the procedure. The IOP normalised on the 3rd and 7th day of treatment . It was found out that the patients treated in the Timolol group had a mean rise in IOP of 4.18 mm Hg 1 hour after the procedure while the patients in th Brimonidine group had a mean rise of 3.32mm Hg 1 hour after the procedure. The chi- square test comparing rise in IOP in Timolol and Brimonidine Group showed the **p= 0.016** which was statistically very significant . Hence our study concludes that Topical Brimonidine eye drops controls the transient rise in IOP better than Timolol following ND YAG Capsulotony.

CONCLUSION

In the study "Comparing efficacy of Topical Anti Glaucoma Medication in monitoring rise in IOP following Nd-YAG Capsulotomy." had the following outcomes.

1. The initial transient rise in IOP following ND YAG Capsulotomy in patients of the brimonidine group was significantly less than the Timolol group.

2. Normalisation of IOP was same in both the Timolol Group and Brimonidine group .

3. Even though after 4 hours of procedure IOP in both groups normalised the initial difference in transient rise of IOP in both the groups was statistically significant. (IOP rise was higher with Timolol group than Brimonidine group).

4. The better control of this initial slight and transient rise of IOP is more important in cases of Pre existing Glaucoma.

5. This is of greater significance particularly in patients with Pre existing Glaucoma with compromised optic nerve head perfusion where even a transient and slight elevation of IOP can further jeopardise the already compromised optic nerve head perfusion and can cause further damage.

6. Hence in our study it was found that Topical Brimonidine had a better control in the initial transient rise of IOP following ND YAG Capsulotomy. Hence it can be taken as a valid point of consideration when treating PCO in a case with pre-existing Glaucoma.

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PROFOMA AND DATA COLLECTION

Name of the patient: Case No:

Age:

D.O.A:

Sex:

Date of Cataract Surgery:

Date of Procedure:

Diagnosis: Posterior Capsular Opacification RE/LE

Best corrected visual acuity before Procedure -RE

-LE

Slit lamp examination

RE

LE

Detailed fundus examination

RE

LE

IOP with NCT – RE

-LE

IOP with Applanation tonometry 1 hr. -RE

before the procedure -LE

Central Corneal thickness -RE

-LE

Corrected IOP -RE

-LE

Administration of 0.5 % Timolol Eye drops/ 0.2 % Brimonidine Eye drops 1 hr before the procedure

Nd YAG Capsulotomy RE/LE

No of Shots

Energy

IOP with Applanation tonometry 1 hr. –RE

after the procedure -LE

Central Corneal thickness -RE

-LE

Corrected IOP -RE

-LE

IOP with Applanation tonometry 4 hr. -RE

after the procedure -LE

Central Corneal thickness -RE

-LE

Corrected IOP -RE

-LE

IOP with Applanation tonometry 3rd day -RE

after the procedure -LE

Central Corneal thickness -RE

-LE

Corrected IOP -RE

-LE

IOP with Applanation tonometry 7th day -RE

after the procedure -LE

Central Corneal thickness -RE

-LE

Corrected IOP -RE

-LE

CONSENT FORM

I hereby give my consent to participate in this study " Study to compare the efficacy of 0.5 % Timilol eye drop's vs. 0.2% Brimonidine eye drops in management of rise in IOP following Nd-YAG Capsulotomy ".Purchase of 0.5 % Timilol eye drop's or 0.2% Brimonidine eye drops at my own cost explained to me by the doctor.

The data obtained herein may be used for research and publication.

Name :

Place :

Signature :

ஒப்புதல் படிவம்

பெயர் :

பாலினம் : வயது :

முகவரி :

அரசு கோவை மருத்துவக் கல்லூரியில் கண் மருத்துவத் துறையில் பட்ட மேற்படிப்பு பயிலும் மாணவர் மேற்கொள்ளும் **"யன்.டி.யாஹ் கேப்சுலாட்டமியால் அதிகமாகும் கண் அழுத்தத்தை, டிமோலால் மருந்து மற்றும் பிரிமோனிடின் மருந்து எந்தளவு குறைக்கிறது என்பதை ஒப்பிடுதல்"** குறித்த ஆய்வில் செய்முறை மற்றும் அனைத்து விவரங்களையும் கேட்டுக் கொண்டு எனது சந்தேகங்களை தெளிவுப்படுத்திக் கொண்டேன் என்பதை தெரிவித்துக் கொள்கிறேன்.

நான் இந்த ஆய்வில் முழு சம்மதத்துடனும், சுய சிந்தனையுடனும் கலந்து கொள்ள சம்மதிக்கிறேன்.

இந்த ஆய்வில் என்னுடைய அனைத்து விபரங்கள் பாதுகாக்கப்படுவதுடன் இதன் முடிவுகள் ஆய்விதழில் வெளியிடப்படுவதில் ஆட்சேபனை இல்லை என்பதை தெரிவித்துக் கொள்கிறேன். எந்த நேரத்திலும் இந்த ஆய்விலிருந்து நான் விலகிக் கொள்ள எனக்கு உரிமை உண்டு என்பதையும் அறிவேன்.

இடம் : கையொப்பம் / ரேகை

நாள் :

KEY TO MASTER CHART

Nd YAG – neodymium-doped yttrium aluminium garnet

SIMC – senile immature cataract

SMC – senile mature cataract

PCO – posterior capsular opacification

V/A - visual acuity

UCVA - uncorrected visual acuity

BCVA - best corrected visual acuity

WHO - World Health Organisation

POD - Post operative Day

D.O.A. – Date of Admission

D.O.S. - Date of Surgery

D.O.P. - Date of Procedure

RE - Right eye

LE -Left eye

SLE - Slit lamp examination

IOP- Intra ocular pressure

CCT - Central Corneal Thickness

PH - Pin Hole

PG - Prescribed Glass

PCIOL - Posterior Chamber IOL

NPCB - National program for control of blindness

NCT – Non Contact Tonometer

AT- Applanation Tonometer

IOL – Intra Ocular Lens

CME – Cystoid Macular Edema

IP NO- In Patient Number

OP NO- Out Patient Number

F- Female

M- Male

VN- Vision

Mj- Milli Joules

Mm of hg- millimetres of mercury.

MASTER CHART

SL NO	IP / OP NO	NAME	AGE	SEX	DIAGNOSIS	BCVA	SLE	IOP -NCT	IOP -AT	0.5 % TIMOLOL	0. 2% BRIMONIDINE	ND YAG			IOP -AT 1 HR AFTER LASER	IOP-AT	IOP - AT	IOP-AT	COMPLICATIONS	vn WITH PH	FUNDUS	
									I HR PRIOR			NO OF SHOTS	ENERGY	TOTAL ENERGY	1 HR AFTER LASER	4HR	3 DAY	7 DAY		POST OP	PRE OP	POST OP
1	15683	Natchimuthu	65	F	LE PSEUDOPHAKIA WITH PCO	2\60	NORMAL	18 mm hg	19 mm hg	YES	-	12	1.8 mj	21.6 mj	21.2 mm hg	18.2 mm hg	17.4 mm hg	17.4 mm hg	nil	4\60	hazy view	normal
2	15884	Arokiyam	65	F	LE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	18 mm hg	18.2 mm hg	YES	-	10	1.8 mj	18 mj	23.2 mm hg	18.2 mm hg	18.2 mm hg	18.2 mm hg	nil	6\36 P	hazy view	normal
3	15829	Suppal	75	F	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	18.2 mm hg	YES	-	18	1.8 mj	32.4 mj	22.4 mm hg	18.2 mm hg	18.2 mm hg	18.2mm hg	nil	6\24 p	hazy view	normal
4	8046	Velliammal	76	F	RE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	14 mm hg	13.7 mm hg	YES	-	9	2.5 mj	22.5 mj	17.7 mm hg	17.7 mm hg	13.7 mm hg	13.7 mm hg	nil	6\18 p	hazy view	normal
5	6328	Chinnakanu	60	F	RE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	18 mm hg	20.7 mm hg	YES	-	10	2.5 mj	25 mj	26.7 mm hg	22.7 mm hg	20.7 mm hg	20.7 mm hg	nil	6\12	hazy view	normal
6	2319	Rangammal	62	F	RE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	12 mm hg	11.2 mm hg	YES	-	10	2.5 mj	25 mj	15.2 mm hg	10.2 mm hg	11.2 mm hg	9.2 mm hg	nil	6\18	hazy view	normal
7	8675	Karuppathal	67	F	LE PSEUDOPHAKIA WITH PCO	1/2 \60	NORMAL	12 mm hg	16 mm hg	YES	-	7	2.5 mj	17.5 mj	19 mm hg	19 mm hg	16 mm hg	16 mm hg	nil	3\60	hazy view	normal
8	19990	Lalitha	58	F	LE PSEUDOPHAKIA WITH PCO	6\12 p	NORMAL	13 mm hg	12.6 mm hg	YES	-	12	1.8 mj	21.6 mj	16.6 mm hg	12.6 mm hg	12.6 mm hg	12.6 mm hg	nil	6\9	hazy view	normal
9	7834	Mariyammal	76	F	LE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	18 mm hg	16 mm hg	YES	-	6	7 mj	42 mj	19.4 mm hg	17.4 mm hg	15.4 mm hg	15.4 mm hg	nil	6\18	hazy view	normal
10	9469	Mylathal	70	F	LE PSEUDOPHAKIA WITH PCO	4\60	NORMAL	10 mm hg	13.9 mm hg	YES	-	6	1.8 mj	10.8 mj	17.9 mm hg	15.9 mm hg	13.9 mm hg	13.9 mm hg	nil	5\60	hazy view	normal
11	4562	Mani	55	F	LE PSEUDOPHAKIA WITH PCO	6\36 p	NORMAL	17 mm hg	20.9 mm hg	YES	-	11	7 mj	77 mj	24.9 mm hg	24.9mm hg	20.9 mm hg	20.9 mm hg	nil	6\24	hazy view	normal
12	60817	Samthiram	65	F	LE PSEUDOPHAKIA WITH PCO	2\60	NORMAL	15 mm hg	20.1 mm hg	YES	-	10	7 mj	70 mj	24.1 mm hg	22.1 mm hg	20.1 mm hg	20.1 mm hg	nil	4\60	hazy view	normal
13	19100	Shanmugam	75	M	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	12 mm hg	13.8 mm hg	YES	-	10	9 mj	90 mj	17.8 mm hg	15.8 mm hg	13.8 mm hg	13.8 mm hg	IOL PITTING	6\36	hazy view	normal
14	9803	Ramasamy	60	M	LE PSEUDOPHAKIA WITH PCO	6\24 pg	NORMAL	16 mm hg	16.7 mm hg	YES	-	7	7 mj	49 mj	22.7 mm hg	18.7 mm hg	16.7 mm hg	16.7 mm hg	nil	6\24	hazy view	normal
15	22427	Ramana	70	M	LE PSEUDOPHAKIA WITH PCO	4\60	NORMAL	16 mm hg	17.8 mm hg	YES	-	6	1.8 mj	10.8 mj	21.8 mm hg	19.8 mm hg	17.8 mm hg	17.8 mm hg	nil	5\60	hazy view	normal
16	698	Ramasamy	63	M	RE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	19 mm hg	19.2 mm hg	YES	-	10	7 mj	70 mj	24.2 mm hg	22.2 mm hg	19.2 mm hg	17.2 mm hg	nil	6\18 p	hazy view	normal
17	544	Noorjahan	75	F	LE PSEUDOPHAKIA WITH PCO	5\60	NORMAL	18 mm hg	19.8 mm hg	YES	-	10	7 mj	70 mj	25.8 mm hg	23.8 mm hg	21.8 mm hg	19.8 mm hg	nil	6\60	hazy view	normal
18	1138	Devi	46	F	RE PSEUDOPHAKIA WITH PCO	6\12	NORMAL	16 mm hg	15.2 mm hg	YES	-	7	4 mj	28 mj	19.2 mm hg	17.2 mm hg	15.2 mm hg	15.2 mm hg	nil	6\6 p	hazy view	normal
19	76354	Sarojini	55	F	LE PSEUDOPHAKIA WITH PCO	1\60	NORMAL	10mm hg	14.2 mm hg	YES	-	8	7 mj	56 mj	17.2 mm hg	15.2 mm hg	14.2 mm hg	14.2 mm hg	nil	3\60	hazy view	normal
20	3565	Hamsha	76	M	LE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	18 mm hg	18.3 mm hg	YES	-	12	1.8 mj	21.6 mj	22.3 mm hg	20.3 mm hg	18.3 mm hg	18.3 mm hg	nil	6\24	hazy view	normal
21	3285	Shivagami	83	F	RE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	15 mm hg	16.2 mm hg	YES	-	11	2.5 mj	22.5 mj	21.2 mm hg	18.2 mm hg	16.2 mm hg	16.2 mm hg	nil	6\24	hazy view	normal
22	8704	Rajan	72	M	LE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	18 mm hg	21 mm hg	YES	-	4	7 mj	28 mj	25 mm hg	23 mm hg	21 mm hg	21 mm hg	nil	6\36 p	hazy view	normal
23	13703	Devani	57	F	LE PSEUDOPHAKIA WITH PCO	6\36 P	NORMAL	19 mm hg	20.9 mm hg	YES	-	11	7 mj	77 mj	24.9 mm hg	20.9 mm hg	20.9 mm hg	20.9 mm hg	nil	6\18 p	hazy view	normal
24	49207	Muthusamy	60	M	LE PSEUDOPHAKIA WITH PCO	6\36 P	NORMAL	20 mm hg	21.2 mm hg	YES	-	12	1.8 mj	21.6 mj	25.2 mm hg	21.2 mm hg	21.2 mm hg	21.2 mm hg	nil	6\24	hazy view	normal
25	4900	Subramanan	54	M	RE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	14 mm hg	17.8 mm hg	YES	-	8	4 mj	32 mj	22.8 mm hg	19.8 mm hg	19.8 mm hg	19.8 mm hg	nil	6\18	hazy view	normal
26	13096	Ganapathy	77	M	RE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	16 mm hg	15.4 mm hg	YES	-	4	3 mj	12 mj	19.4 mm hg	15.4 mm hg	15.4 mm hg	15.4 mm hg	nil	6\18	hazy view	normal
27	10025	Paramasivan	75	M	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	14 mm hg	16.1 mm hg	YES	-	8	4 mj	32 mj	20.1 mm hg	18.1 mm hg	16.1 mm hg	16.1 mm hg	nil	6\24	hazy view	normal
28	10606	Shivajothi	60	M	RE PSEUDOPHAKIA WITH PCO	6\12	NORMAL	20 mm hg	19.4 mm hg	YES	-	10	2.5 mj	25 mj	22.4 mm hg	19.2 mm hg	19.2 mm hg	19.2 mm hg	nil	6\9	hazy view	normal
29	5982	Rajamanikam	64	M	RE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	18 mm hg	17.2 mm hg	YES	-	7	3 mj	21 mj	21.2 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\18	hazy view	normal
30	63077	Jayalakshmi	66	M	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	18.9 mm hg	YES	-	10	2.5 mj	25 mj	21.9 mm hg	18.9 mm hg	18.9 mm hg	18.9 mm hg	nil	6\24	hazy view	normal
31	9694	Chinnamal	70	F	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	18.2 mm hg	YES	-	6	2.5 mj	15 mj	24.2 mm hg	18.2 mm hg	18.2 mm hg	18.2 mm hg	nil	6\24	hazy view	normal
32	6706	Laksmanan	70	M	RE PSEUDOPHAKIA WITH PCO	6\18 P	NORMAL	16 mm hg	17.5 mm hg	YES	-	10	7 mj	70 mj	19.5 mm hg	17.5 mm hg	17.5 mm hg	17.5 mm hg	nil	6\9	hazy view	normal
33	344257	Karninambal	78	M	LE PSEUDOPHAKIA WITH PCO	6\36 p	NORMAL	18 mm hg	15.1 mm hg	YES	-	8	7mj	56 mj	19.1 mm hg	15. 1 mm hg	15. 1 mm hg	15. 1 mm hg	nil	6\18	hazy view	normal
34	8430	Varghese	62	M	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	18.2 mm hg	YES	-	6	7 mj	42 mj	23.2 mm hg	18.2 mm hg	18.2 mm hg	18.2 mm hg	nil	6\24	hazy view	normal
35	8462	Rajeshwari	53	F	RE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	16 mm hg	18.5 mm hg	YES	-	10	2.5 mj	25 mj	23.5 mm hg	20.5 mm hg	20.5 mm hg	20.5 mm hg	nil	6\24	hazy view	normal
36	8265	Saravanahar	64	M	LE PSEUDOPHAKIA WITH PCO	6\36 P	NORMAL	18 mm hg	18.1 mm hg	YES	-	10	7 mj	70 mj	22.1mm hg	20.1 mm hg	18.1 mm hg	18.1 mm hg	nil	6\24	hazy view	normal
37	8188	Padmanaban	64	M	LE PSEUDOPHAKIA WITH PCO	6\12 P	NORMAL	16 mm hg	16.1 mm hg	YES	-	10	2.5 mj	25 mj	20.1 mm hg	16.1mm hg	16.1mm hg	16.1mm hg	nil	6\9	hazy view	normal
38	7819	Kamatchi	45	F	RE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	16 mm hg	16.2 mm hg	YES	-	7	4 mj	28 mj	20.2 mm hg	20.2 mm hg	20.2 mm hg	20.2 mm hg	nil	6\12 p	hazy view	normal

39	7506	Shantamani	60	F	RE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	16 mm hg	19.5 mm hg	YES	-	10	4 mj	40 mj	23.5 mm hg	19.5 mm hg	19.5 mm hg	19.5 mm hg	nil	6\12	hazy view	normal
40	13790	Papati	42	F	LE PSEUDOPHAKIA WITH PCO	6\12 p	NORMAL	14 mm hg	17.2 mm hg	YES	-	10	2.5mj	25 mj	21.2 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\9	hazy view	normal
41	47101	Rangan	80	M	RE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	14 mm hg	17.8 mm hg	YES	-	15	2.5mj	34.5 mj	23.8 mm hg	21.8 mm hg	17.8 mm hg	17.8 mm hg	nil	6\24	hazy view	normal
42	38597	Velan	70	M	RE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	20 mm hg	20.7 mm hg	YES	-	7	7 mj	49 mj	24.7 mm hg	20.7 mm hg	20.7 mm hg	20.7 mm hg	nil	6\24 p	hazy view	normal
43	33175	Aiyammal	55	F	RE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	14 mm hg	13.2 mm hg	YES	-	10	1.8 mj	18 mj	17.2 mm hg	13.2 mm hg	13.2 mm hg	13.2 mm hg	nil	6\9 p	hazy view	normal
44	11975	Kitan	65	M	RE PSEUDOPHAKIA WITH PCO	6\36 p	NORMAL	16 mm hg	20.7 mm hg	YES	-	7	2.5mj	17.5 mj	25.7 mm hg	22.7 mm hg	20.7 mm hg	20.7 mm hg	nil	6\36	hazy view	normal
45	11594	Jeyamary	54	F	RE PSEUDOPHAKIA WITH PCO	6\18 p	NORMAL	14 mm hg	14.2 mm hg	YES	-	10	7 mj	70 mj	17.2 mm hg	14.2 mm hg	14.2 mm hg	14.2 mm hg	IOL PITTING	6\12	hazy view	normal
46	41435	Yeshodha	64	F	LE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	18 mm hg	18.2 mm hg	YES	-	15	2.5 mj	37.5 mj	24.2 mm hg	18.2 mm hg	18.2 mm hg	18.2 mm hg	nil	6\60	hazy view	normal
47	65	Shangwati	65	F	PSEUDOPHAKIA WITH PCO	6\24	NORMAL	18 mm hg	20.7 mm hg	YES	-	10	2.5 mj	25 mj	24.7 mm hg	22.7 mm hg	20.7 mm hg	20.7 mm hg	nil	6\18	hazy view	normal
48	10786	Papammal	70	F	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	18.2 mm hg	YES	-	8	2.5 mj	20 mj	22.2 mm hg	18.2 mm hg	18.2 mm hg	18.2 mm hg	nil	6\24	hazy view	normal
49	10712	Subancla	67	F	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	20 mm hg	19.1 mm hg	YES	-	5	2.5 mj	12.5 mj	23.1 mm hg	19.1 mm hg	19.1 mm hg	19.1 mm hg	nil	6\24 p	hazy view	normal
50	10632	Singanavelan	65	F	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	14 mm hg	15.2 mm hg	YES	-	10	2.5 mj	25 mj	18.2 mm hg	15.2 mm hg	15.2 mm hg	15.2 mm hg	nil	6\24 p	hazy view	normal
51	7380	Indrani	65	F	RE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	17.2 mm hg	-	YES	12	1.8 mj	21.6 mj	21.4 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\24	hazy view	normal
52	15121	Chinnaraman	70	F	LE PSEUDOPHAKIA WITH PCO	4\60	NORMAL	14 mm hg	13.1 mm hg	-	YES	10	2.5 mj	25 mj	17.1 mm hg	17.1 mm hg	13.1 mm hg	13.1 mm hg	nil	6\60 p	hazy view	normal
53	18696	Aminammal	65	F	RE PSEUDOPHAKIA WITH PCO	6\36 pg	NORMAL	18 mm hg	20.7 mm hg	-	YES	10	2.5 mj	25 mj	23.7mm hg	20.7 mm hg	20.7 mm hg	20.7 mm hg	nil	6\24 p	hazy view	normal
54	7076	Murugesan	65	M	RE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	18 mm hg	17.2 mm hg	-	YES	10	2.5 mj	25 mj	19.2 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\24 p	hazy view	normal
55	70014	Savithri	65	F	RE PSEUDOPHAKIA WITH PCO	4\60	NORMAL	20 mm hg	20.7 mm hg	-	YES	9	2.5 mj	22.5 mj	22.6 mm hg	20.7 mm hg	20.7 mm hg	20.7 mm hg	nil	5\60	hazy view	normal
56	12861	Chinnamal	75	F	LE PSEUDOPHAKIA WITH PCO	5\60	NORMAL	16 mm hg	17 mm hg	-	YES	12	7 mj	84 mj	23 mm hg	19 mm hg	17 mm hg	17 mm hg	IOL PITTING	6\60	hazy view	normal
57	7346	Thandavani	65	M	LE PSEUDOPHAKIA WITH PCO	2\60	NORMAL	18 mm hg	23 mm hg	-	YES	15	2.5 mj	37.5 mj	27 mm hg	23 mm hg	23 mm hg	23 mm hg	nil	4\60	hazy view	normal
58	7405	Mariyathal	55	F	RE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	9 mm hg	13.8 mm hg	-	YES	6	1.8 mj	10.8 mj	17.8 mm hg	15.8 mm hg	13.8 mm hg	13.8 mm hg	nil	6\9 p	hazy view	normal
59	8109	Valliayamal	80	F	RE PSEUDOPHAKIA WITH PCO	1\60	NORMAL	11 mm hg	13.8 mm hg	-	YES	10	7 mj	70 mj	17.8 mm hg	15.8 mm hg	13.8 mm hg	13.8 mm hg	nil	3\60	hazy view	normal
60	1254	Muthulakshmi	55	F	RE PSEUDOPHAKIA WITH PCO	2\60	NORMAL	14 mm hg	17.5 mm hg	-	YES	10	7 mj	70 mj	19.5 mm hg	17.5 mm hg	17.5 mm hg	17.5 mm hg	IOL PITTING	5\60	hazy view	normal
61	7053	Natarajan	60	M	LE PSEUDOPHAKIA WITH PCO	CFCF	NORMAL	10 mm hg	9.9 mm hg	-	YES	8	7 mj	56 mj	14.9 mm hg	9.9 mm hg	9.9 mm hg	9.9 mm hg	nil	3\60	hazy view	normal
62	7285	Mallaya	63	M	LE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	14 mm hg	14.1 mm hg	-	YES	10	7 mj	70 mj	17.1 mm hg	15.1 mm hg	14.1 mm hg	14.1 mm hg	nil	6\18 p	hazy view	normal
63	7274	Pechimuthu	62	F	LE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	14 mm hg	14.5 mm hg	-	YES	13	7 mj	91 mj	16.5 mm hg	14.5 mm hg	14.5 mm hg	14.5 mm hg	nil	6\9	hazy view	normal
64	7374	Arumugam	67	M	RE PSEUDOPHAKIA WITH PCO	6\12	NORMAL	18 mm hg	17.2 mm hg	-	YES	12	2.5 mj	30 mj	21.4 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\9	hazy view	normal
65	7393	Kittamal	62	F	RE PSEUDOPHAKIA WITH PCO	6\36 p	NORMAL	17 mm hg	18.9 mm hg	-	YES	8	7 mj	56 mj	22.9 mm hg	21.9 mm hg	18.9 mm hg	18.9 mm hg	nil	6\12	hazy view	normal
66	8919	Rajadurai	70	M	RE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	12 mm hg	13.5mm hg	-	YES	10	7 mj	70 mj	17.5 mm hg	15.5 mm hg	13.5mm hg	13.5mm hg	nil	6\18	hazy view	normal
67	43361	Parvathy	53	F	RE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	16mm hg	16.2 mm hg	-	YES	8	2.5 mj	20 mj	20.2 mm hg	18.2 mm hg	16.2 mm hg	16.2 mm hg	nil	6\9 p	hazy view	normal
68	7580	Visalakshi	68	F	LE PSEUDOPHAKIA WITH PCO	1\60	NORMAL	11 mm hg	9.2 mm hg	-	YES	10	7 mj	70 mj	13.2 mm hg	11.2 mm hg	9.2 mm hg	9.2 mm hg	nil	4\60	hazy view	normal
69	7255	Velan	65	M	RE PSEUDOPHAKIA WITH PCO	5\60	NORMAL	18 mm hg	20.7 mm hg	-	YES	7	7 mj	49 mj	22.7 mm hg	20.7mm hg	20.7mm hg	20.7mm hg	nil	6\60	hazy view	normal
70	3084	Saminathan	45	M	LE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	14 mm hg	16.2 mm hg	-	YES	7	7 mj	49 mj	19.2 mm hg	18.2 mm hg	16.2 mm hg	16.2 mm hg	nil	6\12 p	hazy view	normal
71	4278	Sundarammal	65	F	LE PSEUDOPHAKIA WITH PCO	6\12	NORMAL	18 mm hg	17.3 mm hg	-	YES	12	2.5 mj	30 mj	21.3 mm hg	19.3 mm hg	17.3 mm hg	17.3 mm hg	nil	6\12 p	hazy view	normal
72	1522	Subramani	44	M	RE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	11 mm hg	10.1 mm hg	-	YES	14	1.8 mj	25.2 mj	14.1 mm hg	10.1 mm hg	10.1 mm hg	10.1 mm hg	nil	6\36 p	hazy view	normal
73	8503	Zeenath	40	F	RE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	17.2 mm hg	-	YES	8	7 mj	56 mj	21.4 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\24 p	hazy view	normal
74	11776	Shanthi	45	F	LE PSEUDOPHAKIA WITH PCO	6\24p	NORMAL	14 mm hg	15.2 mm hg	-	YES	4	1.8 mj	7.2 mj	17.2 mm hg	15.2 mm hg	15.2 mm hg	15.2 mm hg	nil	6\18	hazy view	normal
75	702	Saraswathi	57	F	RE PSEUDOPHAKIA WITH PCO	6\36 p	NORMAL	14 mm hg	17.8 mm hg	-	YES	6	2.5 mj	15 mj	19.8 mm hg	17.8 mm hg	17.8 mm hg	17.8 mm hg	nil	6\18 p	hazy view	normal
76	5214	Veeramal	60	F	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	19.1 mm hg	-	YES	12	2.5 mj	30 mj	23.1 mm hg	19.1 mm hg	19.1 mm hg	19.1 mm hg	nil	6\24 p	hazy view	normal
77	8909	Vishwanathan	60	M	RE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	17.2 mm hg	-	YES	10	1.8 mj	18 mj	21.4 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\24 p	hazy view	normal
78	843	Krishnan	82	M	RE PSEUDOPHAKIA WITH PCO	6\36 p	NORMAL	18 mm hg	20.7 mm hg	-	YES	10	2.5 mj	25 mj	23.7 mm hg	20.7 mm hg	20.7 mm hg	20.7 mm hg	nil	6\36 p	hazy view	normal
79	8247	Nanjammal	65	F	RE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	16mm hg	17.2 mm hg	-	YES	10	2.5 mj	25 mj	19.2 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\24 p	hazy view	normal
80	9816	Athmaram	65	M	LE PSEUDOPHAKIA WITH PCO	4\60	NORMAL	14mm hg	15.1 mm hg	-	YES	10	7 mj	70 mj	17.1 mm hg	15.1 mm hg	15.1 mm hg	15.1 mm hg	nil	6\60	hazy view	normal

81	1007	Nagarathnama	54	F	RE PSEUDOPHAKIA WITH PCO	6\36 PG	NORMAL	18 mm hg	20.7 mm hg	-	YES	3	2.5 mj	7.5 mj	24.7 mm hg	22.7 mm hg	20.7 mm hg	20.7 mm hg	nil	6\24 p	hazy view	normal
82	10022	Rukumini	70	F	RE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	18 mm hg	17.2 mm hg	-	YES	10	2.5 mj	25 mj	19.2 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\24	hazy view	normal
83	16089	Velusamy	56	M	LE PSEUDOPHAKIA WITH PCO	3\60	NORMAL	20 mm hg	23 mm hg	-	YES	12	2.5 mj	30 mj	28 mm hg	23 mm hg	23 mm hg	23 mm hg	nil	5\60	hazy view	normal
84	13264	Ramasamy	75	M	LE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	12 mm hg	16 mm hg	-	YES	12	2.5 mj	30 mj	19 mm hg	16 mm hg	16 mm hg	16 mm hg	nil	6\12 p	hazy view	normal
85	52793	Arumugam	65	M	LE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	14 mm hg	17.2 mm hg	-	YES	14	1.8 mj	25.2 mj	20.2mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\60	hazy view	normal
86	15048	Chinnasamy	70	M	LE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	16 mm hg	19.2 mm hg	-	YES	12	2.5 mj	30 mj	21.2 mm hg	19.2 mm hg	19.2 mm hg	19.2 mm hg	nil	6\12 p	hazy view	normal
87	15913	Rahim Khan	63	M	LE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	14 mm hg	15.9mm hg	-	YES	13	1.8 mj	23.4 mj	20.9 mm hg	15.9mm hg	15.9mm hg	15.9mm hg	CME	6\12 p	hazy view	CME
88	16010	Muthan	59	M	LE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	14 mm hg	16.mm hg	-	YES	15	1.8 mj	27 mj	19.1 mm hg	16.1 mm hg	16.1 mm hg	16.1 mm hg	nil	6\18 p	hazy view	normal
89	84390	Anandhami	71	M	RE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	17.6 mm hg	-	YES	10	2.5 mj	25 mj	20.6 mm hg	17.6 mm hg	17.6 mm hg	17.6 mm hg	nil	6\18 p	hazy view	normal
90	13084	Chinnaraj	42	M	RE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	16 mm hg	18.5 mm hg	-	YES	7	2.5 mj	17.5 mj	22.5 mm hg	20.5 mm hg	18.5 mm hg	18.5 mm hg	nil	6\18	hazy view	normal
91	97	Manikandam	43	M	LE PSEUDOPHAKIA WITH PCO	6\18	NORMAL	18 mm hg	18.2 mm hg	-	YES	4	7 mj	28 mj	22.2 mm hg	18.2 mm hg	18.2 mm hg	18.2 mm hg	nil	6\18	hazy view	normal
92	18154	Lakshmi	65	F	LE PSEUDOPHAKIA WITH PCO	6\36 p	NORMAL	18 mm hg	15.1 mm hg	-	YES	8	7 mj	56 mj	18.1 mm hg	15.1 mm hg	15.1 mm hg	15.1 mm hg	nil	6\18	hazy view	normal
93	4624	Sadachiyammal	70	F	LE PSEUDOPHAKIA WITH PCO	6\18 p	NORMAL	16 mm hg	17.8 mm hg	-	YES	2	1.8 mj	3.6 mj	20.8 mm hg	17.8 mm hg	17.8 mm hg	17.8 mm hg	nil	6\12 p	hazy view	normal
94	12248	Pappamal	55	F	LE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	18 mm hg	18.2 mm hg	-	YES	6	1.8 mj	10.8mj	21.2 mm hg	18.2 mm hg	18.2 mm hg	18.2 mm hg	nil	6\36 p	hazy view	normal
95	3639	Ramal	55	F	RE PSEUDOPHAKIA WITH PCO	6\60	NORMAL	20 mm hg	20.7 mm hg	-	YES	10	2.5 mj	25 mj	22.7 mm hg	20.7 mm hg	20.7 mm hg	20.7 mm hg	nil	6\36 p	hazy view	normal
96	4759	Asapatham	42	F	RE PSEUDOPHAKIA WITH PCO	6\24	NORMAL	18 mm hg	17.2 mm hg	-	YES	12	1.8 mj	21.8 mj	20.2 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\18 p	hazy view	normal
97	19825	Nallamal	65	F	LE PSEUDOPHAKIA WITH PCO	6\12	NORMAL	17 mm hg	17.3 mm hg	-	YES	7	2.5 mj	17.5 mj	21.3 mm hg	17.3 mm hg	17.3 mm hg	17.3 mm hg	nil	6\9	hazy view	normal
98	48247	Arumugam	66	M	RE PSEUDOPHAKIA WITH PCO	6\36	NORMAL	12 mm hg	14.1 mm hg	-	YES	6	4 mj	24 mj	16.2 mm hg	14.1 mm hg	14.1 mm hg	14.1 mm hg	nil	6\18 p	hazy view	normal
99	6695	Shanmugavel	64	M	RE PSEUDOPHAKIA WITH PCO	6\36 p	NORMAL	18 mm hg	17.2 mm hg	-	YES	4	4 mj	16 mj	20.4 mm hg	17.2 mm hg	17.2 mm hg	17.2 mm hg	nil	6\36	hazy view	normal
100	3742	Samuel	66	M	LE PSEUDOPHAKIA WITH PCO	6\24 p	NORMAL	14 mm hg	15.4 mm hg	-	YES	10	7 mj	70 mj	18.4 mm hg	15.4 mm hg	15.4 mm hg	15.4 mm hg	nil	6\18	hazy view	normal